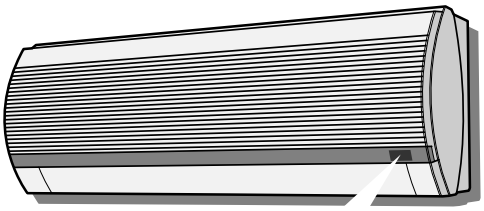
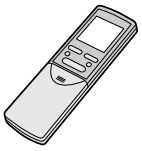
SHARP SERVICE MANUAL

S8236AYX10CRN





SPLIT TYPE
ROOM AIR CONDITIONERS

MODELS

INDOOR UNIT
AY-X10CR(FOR SWEDEN ONLY)
AY-X10CR-N

OUTDOOR UNIT
AE-X10CR(FOR SWEDEN ONLY)
AE-X10CR-N

In the interests of user-safety (Required by safety regulations in some countries) the set should be restored to its original condition and only parts identical to those specified should be used.

New Refrigerant : R-410A

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SHARP CORPORATION

SPECIFICATIONS

ITEMS \ MODEL			INDOOR UNIT AY-X10CR-N, AY-X10CR	OUTDOOR UNIT AE-X10CR-N, AE-X10CR
Cooling capacity(Min. ~ Max.)		kW	2.8(0.9 – 3.3)	
Heating capacity(Min. ~ Max.)		kW	3.7(0.9 – 5.0)	
Moisture removal(at cooling)		Liters/h	0.8	

Electrical data

Phase			Single	
Rated frequency		Hz	50	
Rated voltage range		V	198 to 264	
Rated voltage		V	220 - 240	
Rated current ★	Cool	A	4.3 – 4.0	
	Heat	A	4.9 – 4.5	
Rated input ★	Cool	W	930	
	Heat	W	1050	
Power factor ★	Cool	%	98 – 97	
	Heat	%	97 – 97	
Compressor	Type		Hermetically sealed rotary type	
	Model		DA89X1F-20F	
	Oil charge		Ester oil VG68 370ml	
Refrigerant system	Evaporator		Louver Fin and Grooved tube type	
	Condenser		Corrugate Fin and Grooved tube type	
	Control		Capillary tube	
	Refrigerant volume (R-410A)		770g	
	De-Ice system		Micro computer controled reversed systems	
Noise level (at cooling)	High	dB(A)	36	43
	Med.	dB(A)	32	–
	Low	dB(A)	27	–

Fan system

Drive			Direct drive	
Air flow quantity (at cooling)	High	m^3/min.	9.8	27.7
	Med.	m^3/min.	8.2	–
	Low	m^3/min.	6.1	–
Fan			Cross flow fan	Propeller fan

Connections

Refrigerant coupling	Flare type
Refrigerant tube size Gas, Liquid	3/8", 1/4"
Drain piping mm	O.D ø 18

Others

Safety device			Compressor: Compressor thermistor	
			Fan motors: Thermal fuse	
			Fuse, Micro computer control	
Air filters			Polypropylene net (Washable)	
Net dimensions	Width	mm	815	780
	Height	mm	278	540
	Depth	mm	198	269
Net weight		kg	10	33

Note: The condition of star " ★ " marked item are 'ISO5151' : 1994(E), condition T1.

EXTERNAL DIMENSIONS

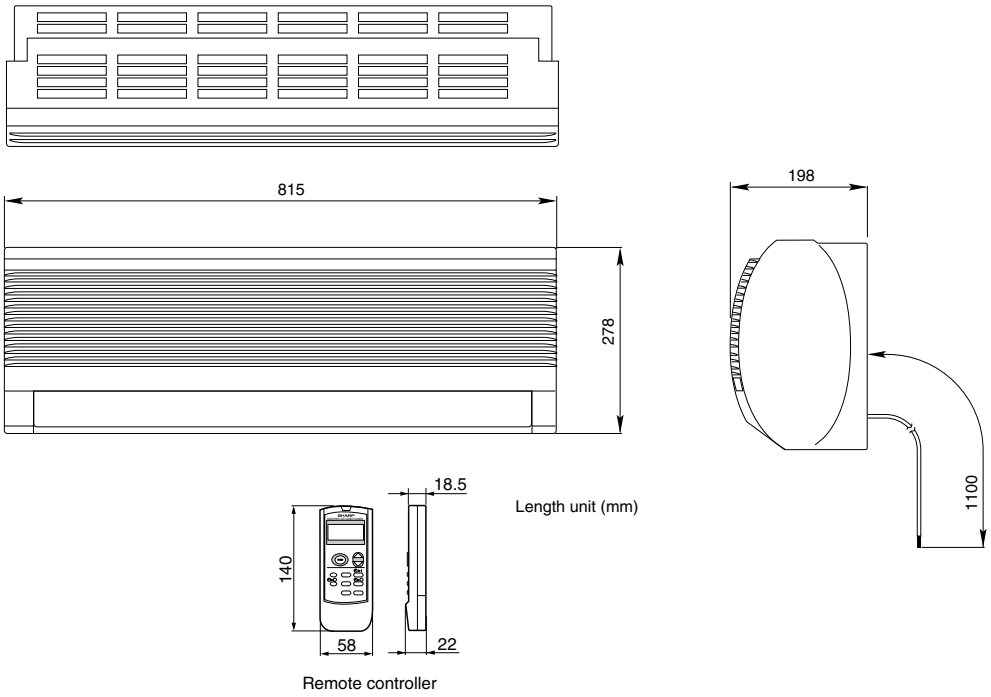


Figure E-1. INDOOR UNIT

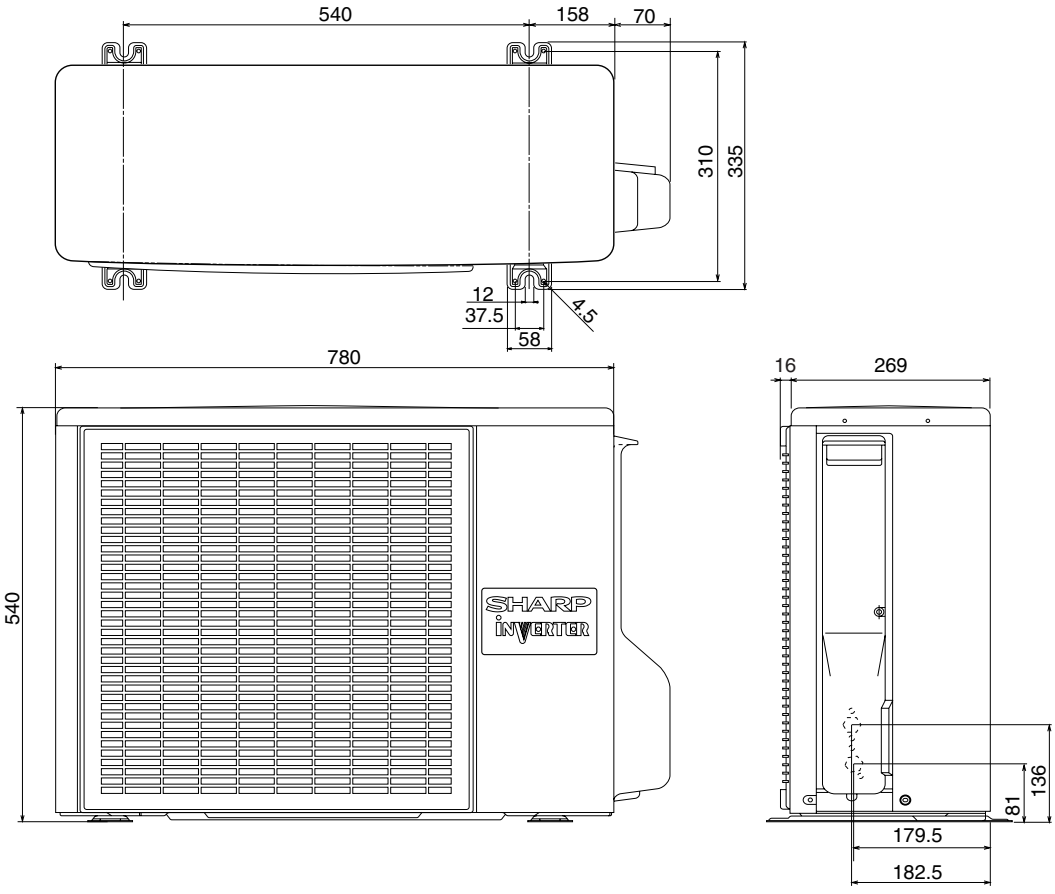


Figure E-2. OUTDOOR UNIT

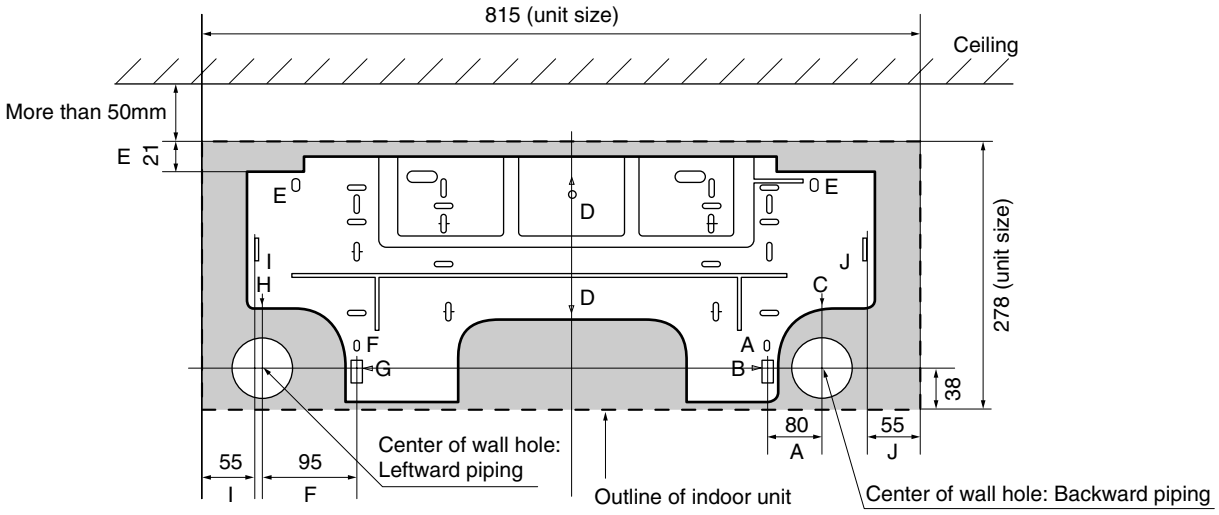
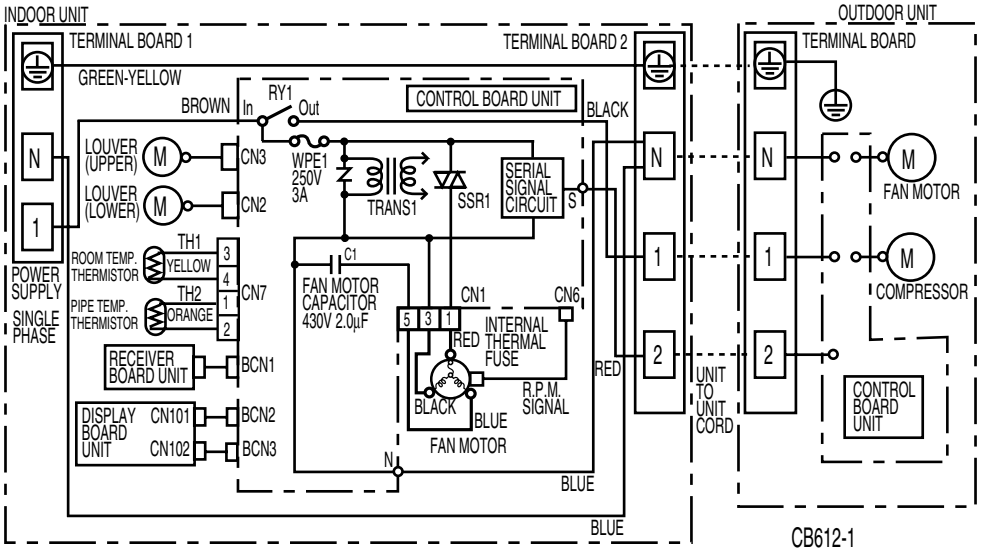


Figure E-3. INSTALLATION DIMENSIONS

WIRING DIAGRAMS



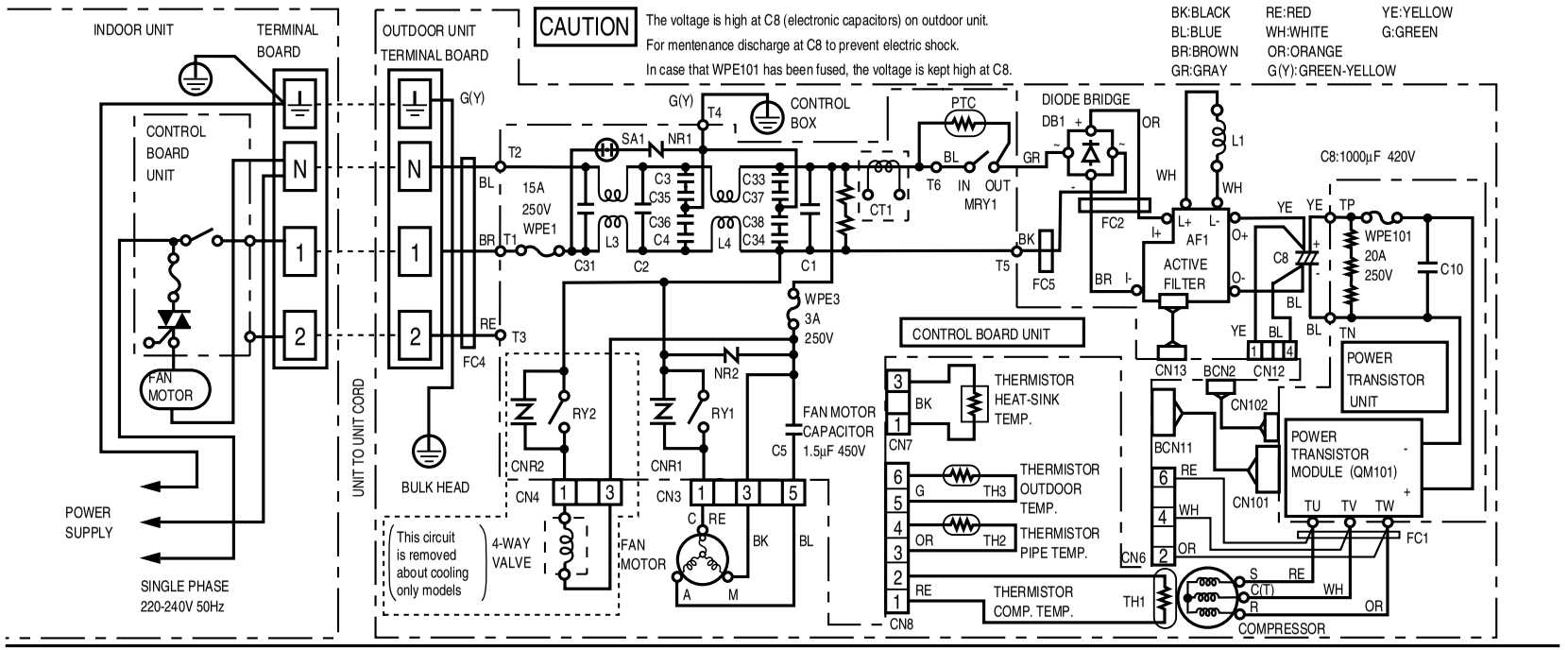
LED INDICATION FOR SELF-DIAGNOSIS

Temperature Indicator Blinking No.	Abnormal contents
1	Short circuit of the outdoor thermistor
2	Overheat of the compressor
3	Abnormal AC current
5	Open circuit of the outdoor thermistor
6	Power module(IPM) abnormality
7	AC overcurrent
8	Open circuit of the power module(IPM) heat-sink thermistor
10	Overheat of the power module(IPM) or short circuit of the power module(IPM) heat-sink thermistor
13	Rotation error of the compressor
14	Power factor module(AF1) error
17	Open circuit of serial signal line
18	Short circuit of serial signal line
19	Abnormal fan motor of indoor unit

<Indication of the abnormal condition>
LED indicator will blink,if the set is in abnormal condition.

CB612-2

Figure W-1. Wiring Diagram for INDOOR UNIT



LED INDICATION OF SELF-DIAGNOSIS

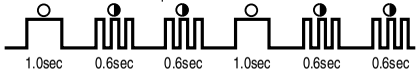
ON OUTDOOR UNIT

	LED BLINKING
●	LED turns on
○	Slow flashing (1 time for 2 seconds)
◑	Quick flashing (3 times for 2 seconds)

NO.	LED indication pattern	Mulfunction part or abnormal condition
	○	Normal
1	●	Abnormal signal line
2	◑ x 2times	Overheat of the compressor
3	◑ x 3times	DC overcurrent of the power module (QM101)
4	◑ x 4times	Short circuit of the thermistor
5	◑ x 5times	Open circuit of the thermistor

NO.	LED indication pattern	Mulfunction part or abnormal condition
6	◑ x 6times	AC abnormal current
7	◑ x 7times	AC overcurrent
8	◑ x 9times	Rotation error of the compressor
9	◑ x 11times	Power factor module(AF1) error
10	◑ x 13times	Overheat of the power module or short circuit of the heat-sink thermistor
11	◑ x 14times	Open circuit of the heat-sink thermistor

Example: NO.2 Overheat of the compressor



NO.3 DC overcurrent of the power module (QM101)

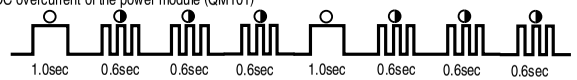


Figure W-2. Wiring Diagram for OUTDOOR UNIT

ELECTRICAL PARTS

For INDOOR UNIT

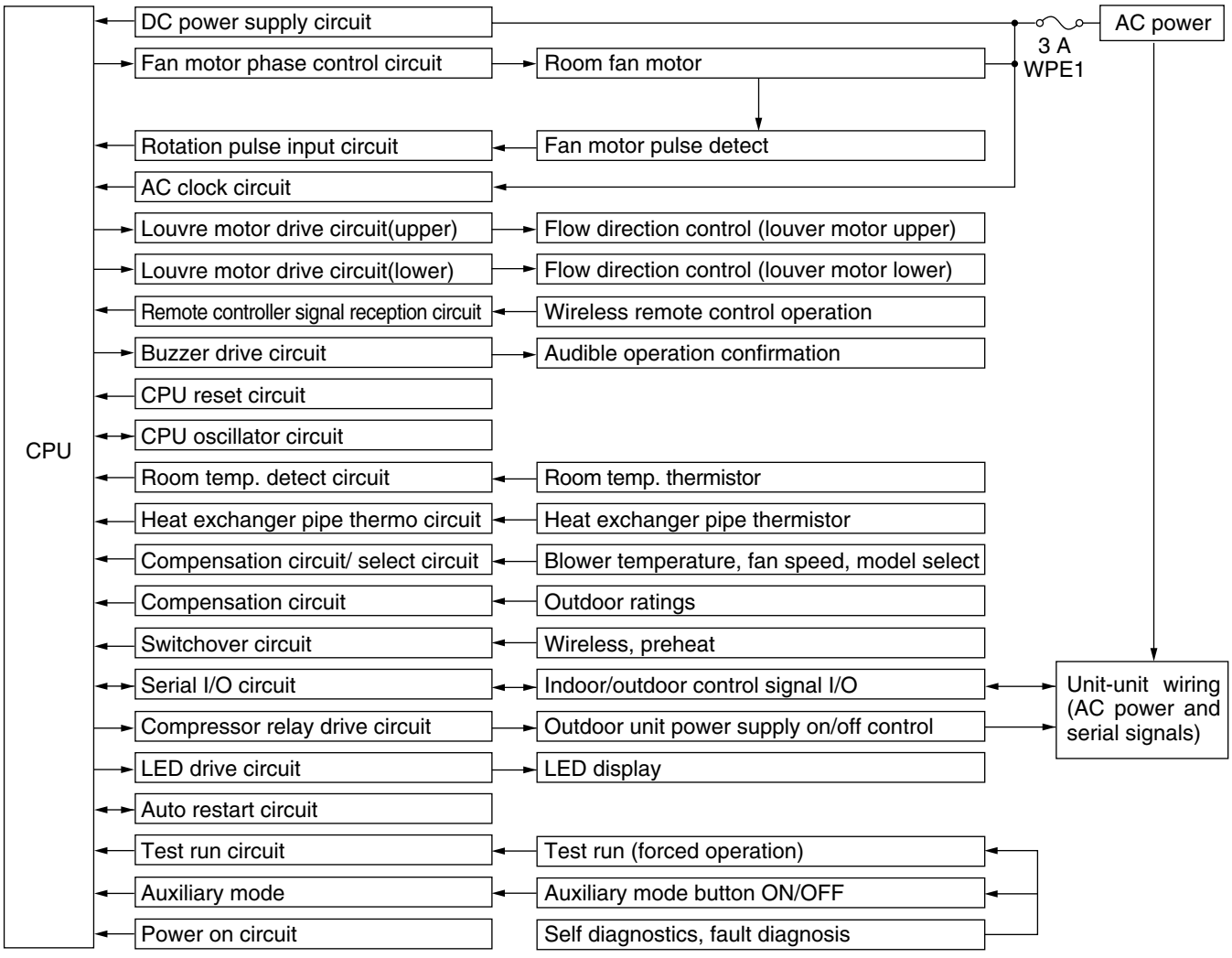
DESCRIPTION	MODEL	REMARKS
Indoor fan motor	ML-A915	220 - 240V, 50Hz
Indoor fan motor capacitor	–	430V, 2μF
Transformer	–	Primary; AC 220 - 240V, 50Hz Secondary; AC19V, 50Hz
WPE1	–	QFS-GA027JBE0 (250V, 3A)

For Model OUYDOOR UNIT

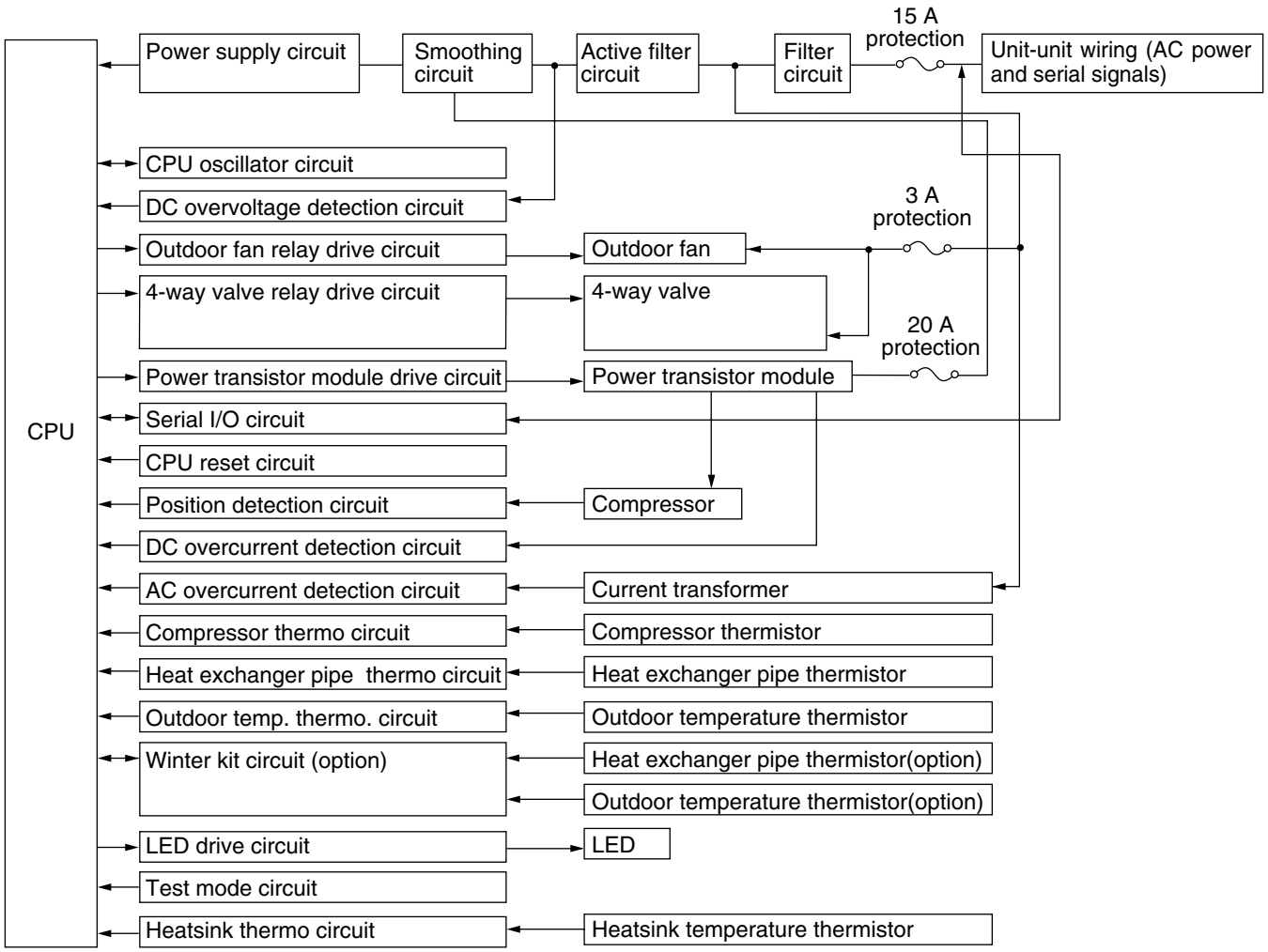
Compressor	DA89X1F	D.C. brush-less motor
Outdoor fan motor	ML-A902	220 - 240V, 50Hz 220V, 60Hz
Outdoor fan motor capacitor	–	450V, 1.5μF
WPE1	–	QFS-GA033JBZZ(15A, 250V)
WPE101	–	QFS-GA019JBE0(20A, 250V)
WPE3	–	QFS-GA008JBE0(3A, 250V) or QFS-GA027JBE0 (3A, 250V)
WPE5	–	QFS-GA037JBZZ(1A, 250V)

BLOCK DIAGRAMS

INDOOR UNIT



OUTDOOR UNIT



MICROCOMPUTER CONTROL SYSTEM

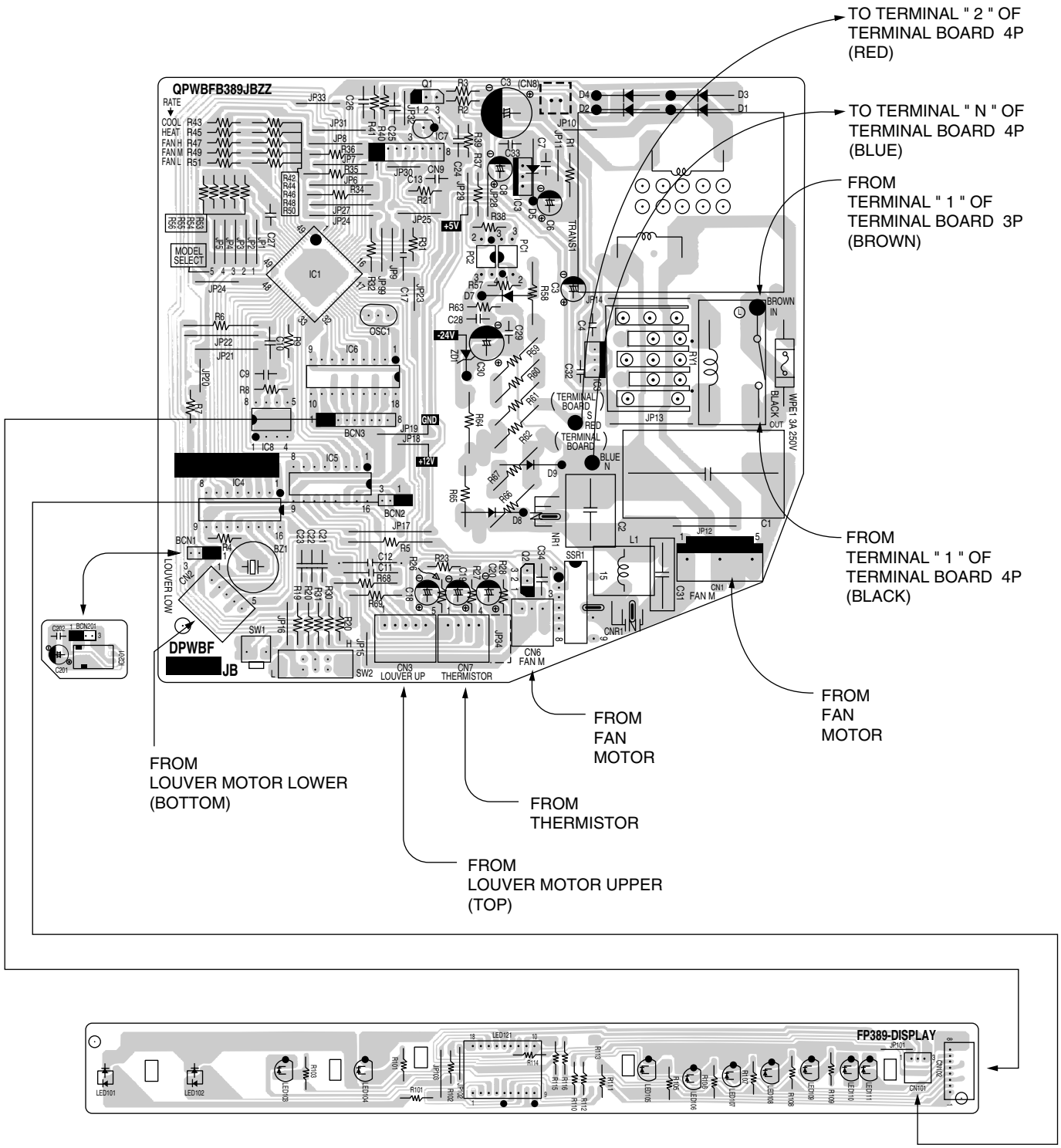


Figure L-1 Printed Wiring Board for INDOOR UNIT

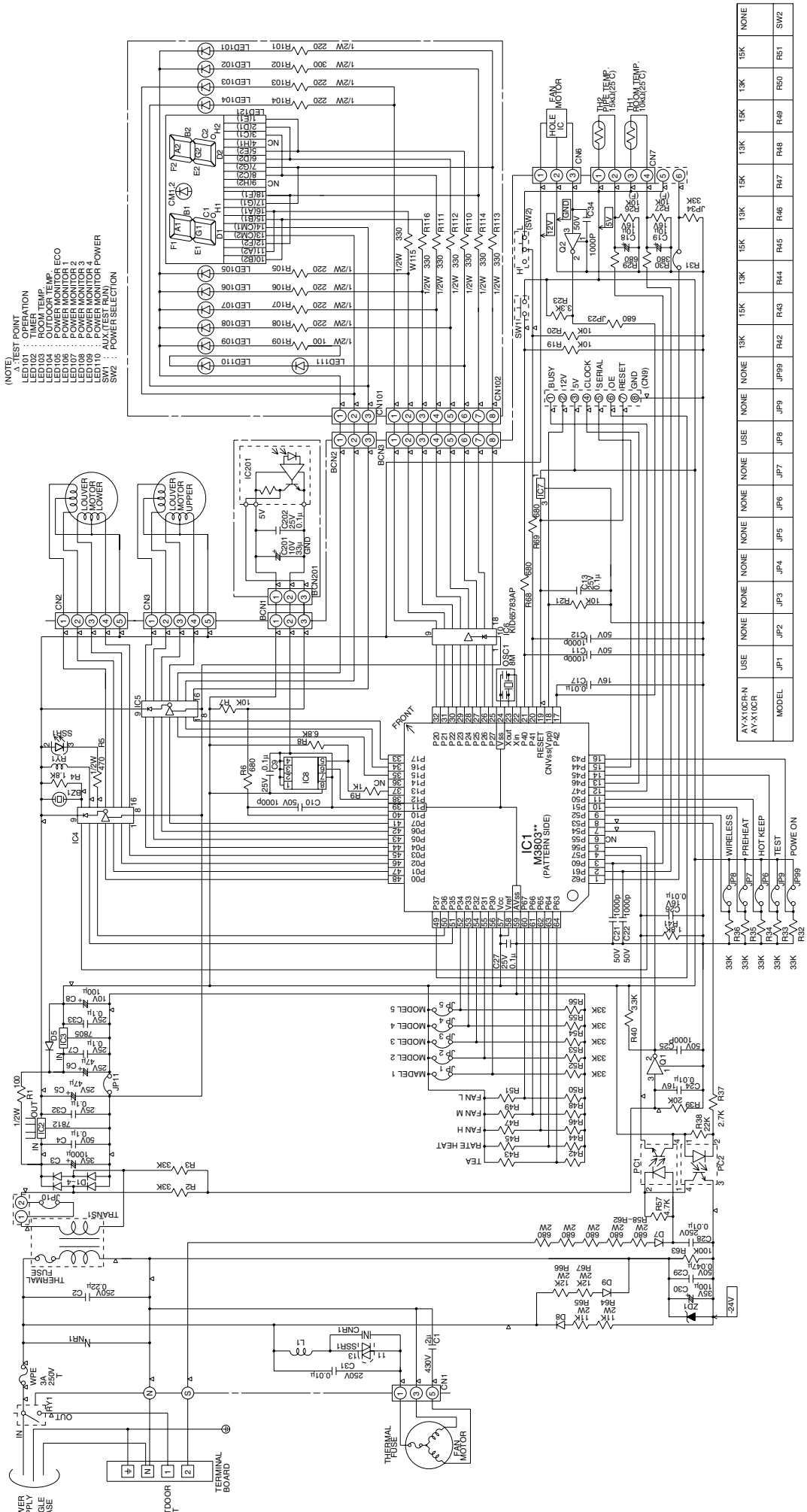


Figure L-2. Electronic Control Circuit Diagram for INDOOR UNIT

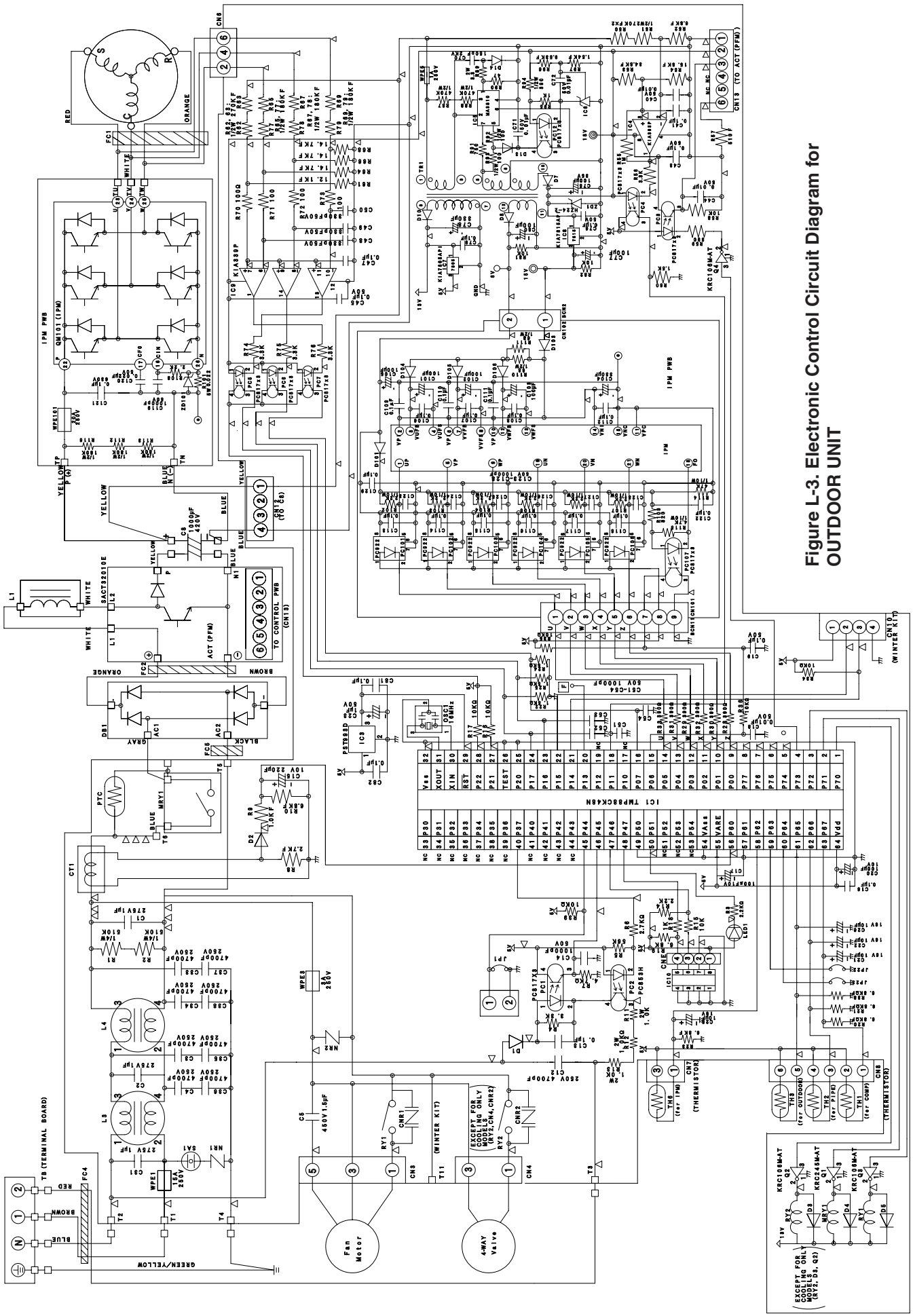


Figure L-3. Electronic Control Circuit Diagram for OUTDOOR UNIT

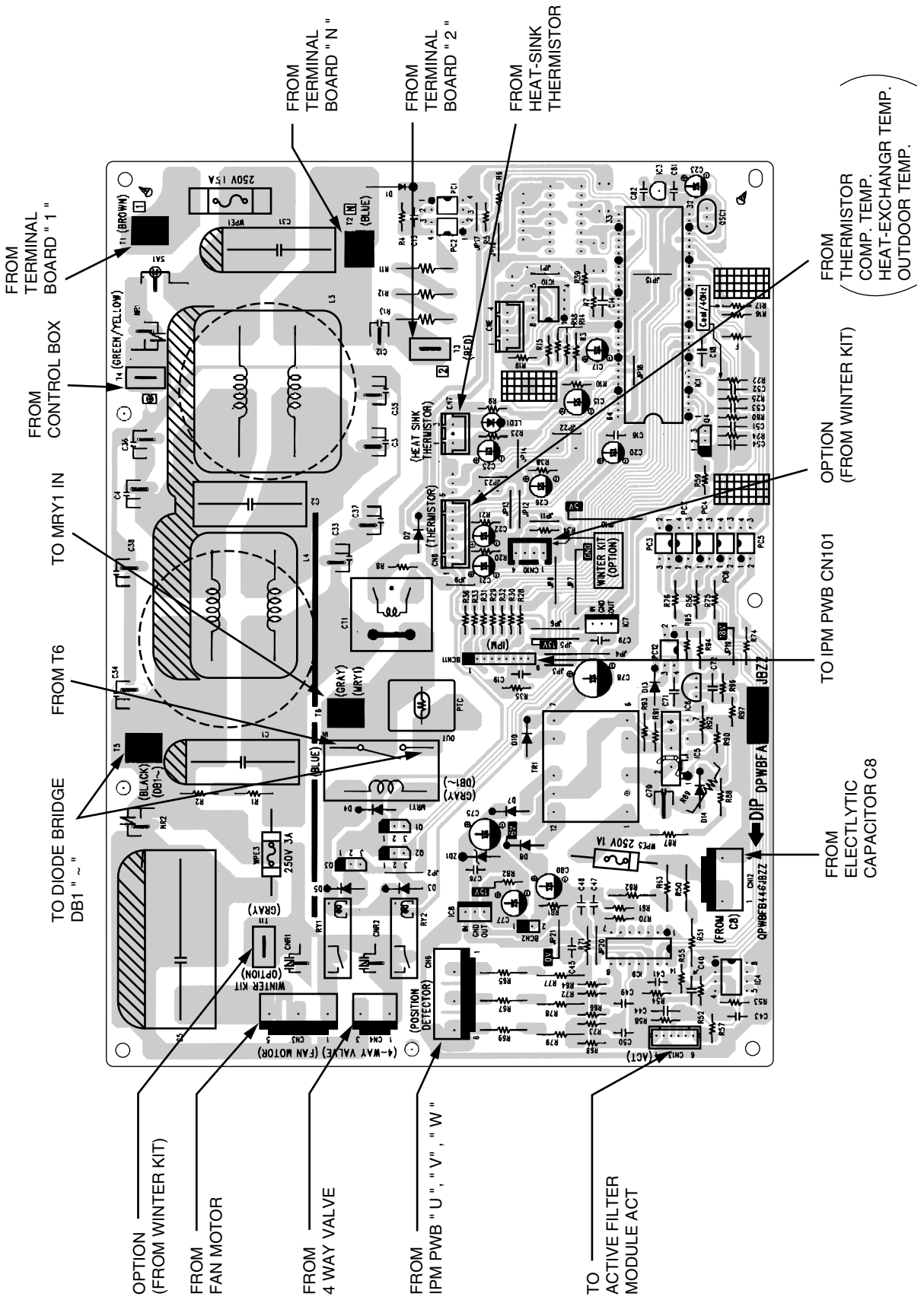

FROM TERMINAL BOARD " 1 "
FROM CONTROL BOX
TO MRY1 IN
FROM T6
TO DIODE BRIDGE DB1 " ~ "
OPTION (FROM WINTER KIT)
FROM FAN MOTOR
FROM 4 WAY VALVE
FROM IPM PWB " U " " V " " W "
TO ACTIVE FILTER MODULE ACT
FROM TERMINAL BOARD " N "
FROM TERMINAL BOARD " 2 "
FROM HEAT-SINK THERMISTOR
FROM THERMISTOR COMP. TEMP. HEAT-EXCHANGR TEMP. OUTDOOR TEMP.
OPTION (FROM WINTER KIT)
TO IPM PWB CN101
FROM ELECTLYTIC CAPACITOR C8

Figure L-4. Printed Wiring Board for OUTDOOR UNIT

FUNCTIONS

1. INDOOR UNIT

1-1 Temperature Adjustment

a. Normal control

Proportional control (P control)

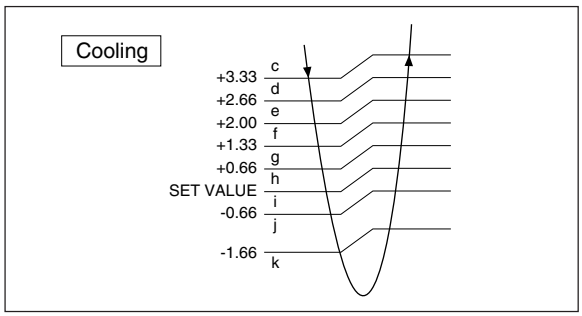
When the temperature zone changes, this control changes the frequency by one rank to move closer to the set value.

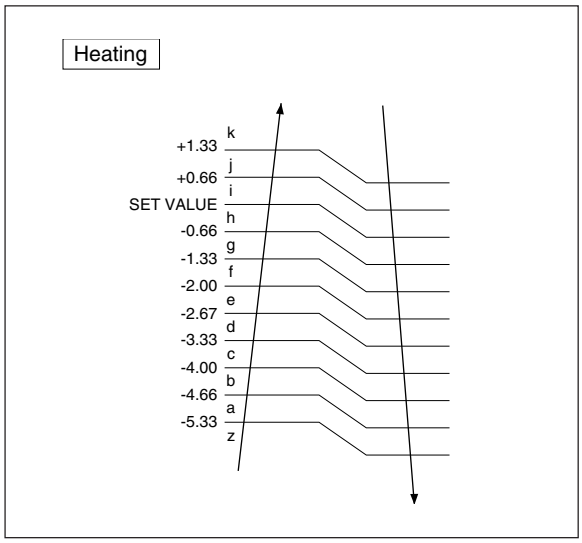
Integral control (I control)

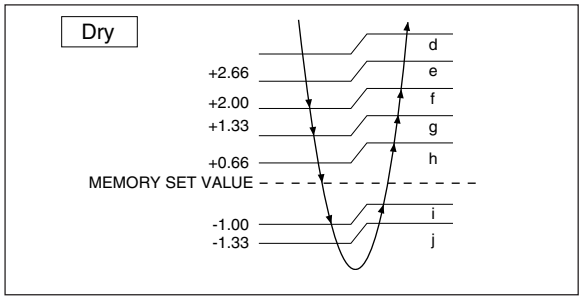
When the temperature zone has set time in the same zone, this control changes the frequency by one rank to move closer to the set value. (Excluding the h zone.)

b. Initial control

The initial frequency is determined as shown in the tables below based on the difference between the temperature adjustment setting at the beginning of operation and the room temperature. After operation begins, normal control is performed and therefore the correspondences in the tables below will not hold.







Cooling	
Room temp. zone	Frequency Code
c	9
d	8
e	7
f	5
g	3
h	2
i	1
j	OFF
k	OFF

Heating	
Room temp. zone	Frequency Code
k	OFF (Hot keep fan)
j	1
i	1
h	2
g	3
f	4
e	5
d	6
c	8
b	A
a	B
z	C

Dry	
Room temp. zone	Frequency Code
d	5
e	4
f	3
g	2
h2	2
h1	1
i	1
j	0

Although the initial value of the h zone is 1, it changes to 2 after a lapse of 15 minutes.

Full power operation only

c. Temperature adjustment

The temperature adjustment range is changed by changing the operating mode with the operation switch.

(1) Heating

If the room temperature is in the z zone when operation begins, proportional/integral control is not performed, and the machine runs at frequency code c full power until the i zone is reached. When the i zone is reached, the frequency changes to the frequency code determined by fuzzy calculation, and after that proportional/integral control is performed.

(2) Cooling

If the room temperature is in the c zone when operation begins,proportional/integral control is not performed, and the machine runs at frequency code 9 power until the i zone is reached. When the h zone is reached, the frequency changes to the frequency code determined by fuzzy calculation, and after that integral control is performed.

(3) Dry

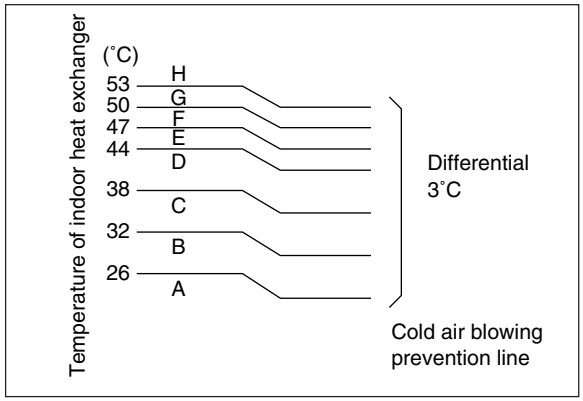
After operation begins, 2 minutes (running at the h zone) of the room temperature is stored in memory, and that becomes the set value.

(4) Circulation

The frequency code 0 is sent to the outdoor machine, and only the fan of the indoor machine runs, the compressor does not run.

1-2 Indoor fan control

This control uses the thermistor for the indoor heat exchanger to control cold air blowing prevention, the indoor fan, and overheating prevention.



(1) Control for indoor freezing prevention

If the temperature of the indoor heat exchanger stays below approximately 0°C for four minutes during cooling or dry, this control stops the compressor. Over 2˚C the compressor will run again.

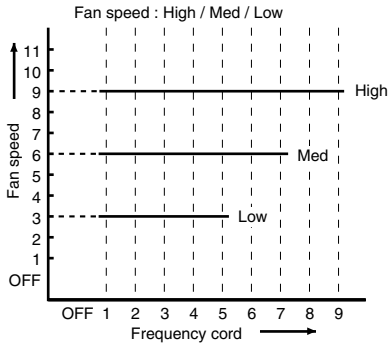
(2) Control for cold air blowing prevention

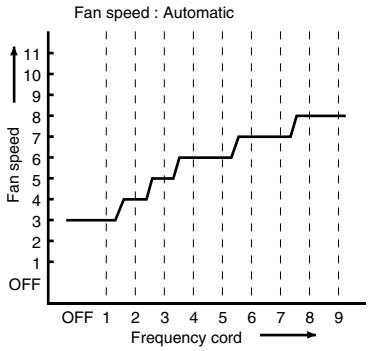
When heating begins, this control stops the indoor fan until the temperature of the indoor heat exchanger reaches 26°C. It also stops the fan if the temperature goes below 23°C during operation.

(3) Indoor fan and operating frequency

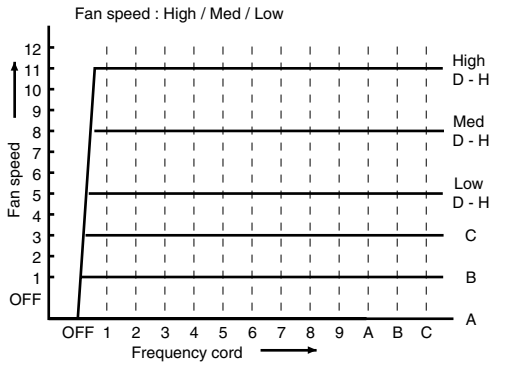
The indoor fan has 12 speeds, and changing is done in four stages, "Auto", "High", "Med", and "Low". The relations between the indoor fan speed, air quantity setting, operating frequency, and indoor heat exchanger are shown in the following charts.

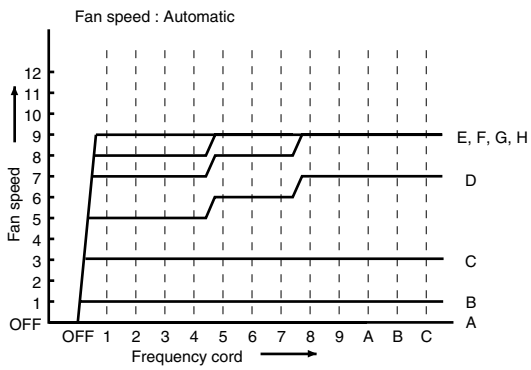
COOLING

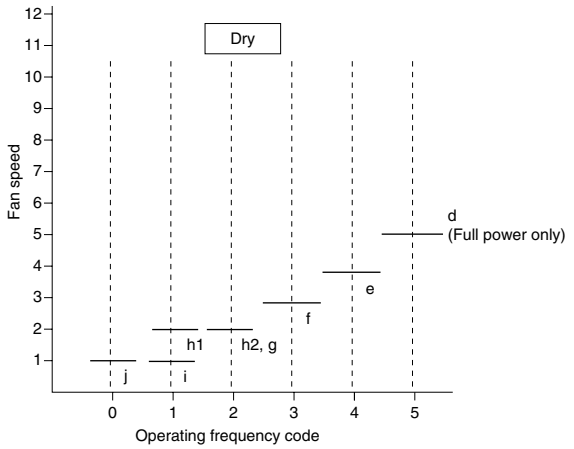




HEATING



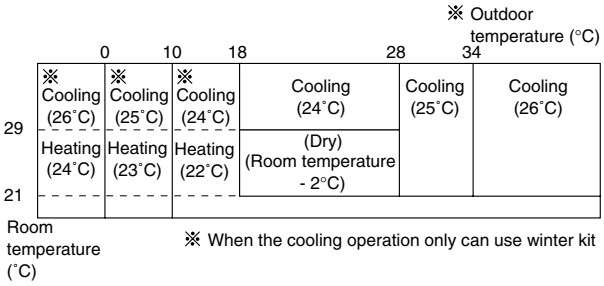




1-3 Automatic operation

The operating mode and temperature setting are determined by the room temperature and the external air temperature.

The operating mode will changeover automatically with the following condition.



1. From cooling to heating
   Cooling mode will changeover to heating mode when condition of indoor temperature 1.7˚C lower than the set temperature conditions for 5 minutes.
2. From heating to cooling
   Heating mode will change over to cooling mode when condition of indoor temperature 1.3˚C higher than the set temperature conditions for 25 minutes under Hot keep condition.
3. When the set temperature is adjusted within the range of ±2˚C by the remote control's key. (▼ ▲), the changeover judgement room temp. will also be shifted within the range of ±2˚C.

1-4 ON-timer

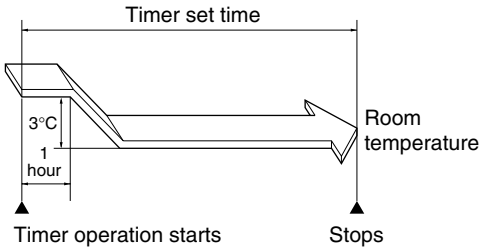
The ON-timer is set by pressing the ON-timer button. In order to attain the set temperature at the set time, the operation starting time is corrected by fuzzy computing one hour before the set time.

1-5 OFF-timer

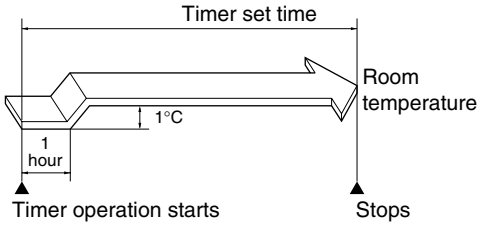
The OFF-timer is set by pressing the OFF-timer button. Operation is as follows:

	Set temperature
Cooling Heating	By fuzzy computing Set the shift up time Final (Cooling setting + 1°C / Heating setting - 3°C)
Dry	Same as above (Final setting + 1°C)

*During Heating



*During Cooling / Dry



1-6 Swing louvres

Louvres are moved by a stepping motors to perform swing and fixing in the set position. If the "FLOW DIRECTION" button is pressed during swing, they will stop. If the "FLOW DIRECTION" button is pressed while they are stopped, they will swing.

1-7 Restart control

Once the compressor stops, this control prevents it from starting again for 3 minutes. It also prevents starting for 80 seconds immediately following plugging into the power outlet.

1-8 One-hour operation

If this button is pressed when operation is stopped, operation will begin and then stop after 1 hour. If pressed when it is operating, will stop after one hour.

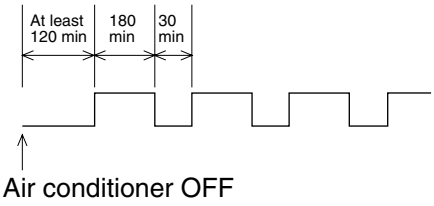
1-9 Full power operation

Immediately begins cooling or heating at maximum power and air flow.

(During heating) Operates at setting of 32°C.
(During cooling) Operates at setting of 18°C.

1-10 Preheat

When heating is stopped, supplies a small amount of power to the compressor to make heating start more quickly. Operates when the indoor temperature sensor and external air sensor detect that the room temperature and outdoor temperature are low (below 18°C and 5°C, respectively). Stops when the compressor chamber temperature rises above 25°C. Preheat does not operate for 2 hours after heating is stopped. After that, it goes on for 180 minutes and then stops for 30 minutes, repeatedly.

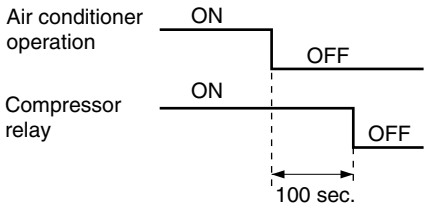


1-11 Power ON start

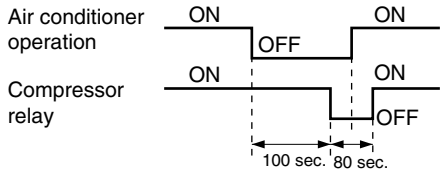
If a jumper wire is inserted into the place indicated JP99 on the indoor control board, and the power plug is inserted. cooling or heating will be automatically determined by the room temperature sensor on the main unit, and operation will begin.

1-12 Compressor relay

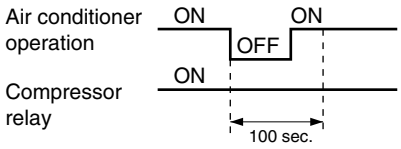
(1) It is ON during operation, and when operation is stopped, goes OFF after a delay of 100 seconds (not immediately).



(2) The minimum OFF time of the relay is 80 seconds. It will not go ON again before 80 seconds elapses.



(3) If air conditioner operation is turned on again during the 100 second delay before the compressor relay goes off, the compressor relay will stay on.



1-13 Auto Restart

When power failure occures, after power is recovered, the unit will automatically restart in the same setting which were active before the power failure.

Operating mode (Cool, Heat, Dry)
- Temperature adjustment (within 2˚C range) automatic operation
- Temperature setting
- Fan setting
- Air flow direction
- Power ON/OFF
- Automatic operation mode setting
- Swing louver

Setting not memorized
- Timer setting
- Full power setting

1-14 Indoor/outdoor temperature display

Every time the Temperature check button is pressed on the remote control, the display changes in the order of indoor temperature ⟶ outdoor temperature ⟶ no display. The temperature is displayed on the temperature indicator on the main unit to be referred to for energy saving.
(When the unit is not running, the display changes between indoor temperature and no display.)Indoor temperature is the temperature of the suction air measured by the room thermistor, and outdoor temperature is that measured by the outdoor temperature thermistor. When indoor temperature is displayed, the indoor LED on the main unit is lit, and when outdoor temperature is displayed, the outdoor LED is lit. For 90 seconds after the operation starts, - - is displayed instead of the actual outdoor temperature since it is still being measured.Because of the effect of the exchanger, the unit cannot confirm the exact indoor temperature right after the operation is terminated. Therefore, for one hour since the operation is stopped, the indoor temperature immediately before the operation is stopped is displayed. After over one hour since it is stopped, the unit displays the actual room temperature at that point.

1-15 Error diagnostic display

(a) Indoor unit

(1) When an error is detected, all relays are turned off. At the same time, the details of the error are displayed by flashing the number corresponding to the type of the error. The details can also be displayed by pressing down the emergency operation switch for 5 seconds or more in the state of operation stop.However, if the operation is continued only in the serial open state and the state remains unchanged after that, the main relay is turned off in 8 minutes. In the serial short state, the error is not displayed and the operation is continued. If the unit stays in the same state, the main relay is turned off in 8 minutes. Although the error is not displayed, it is memorized and can be displayed when it is recalled.

(2) If the operation is stopped and the emergency operation button is pressed down for 5 seconds or more, the self-diagnosis memory can be recalled.

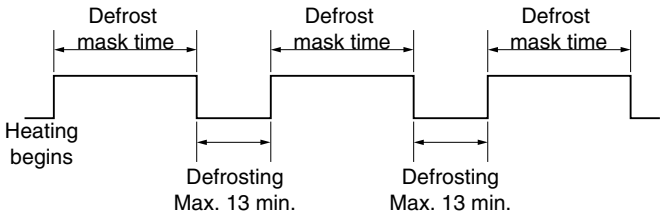
(3) Details of self-diagnosis (error mode) are informed by the flashing number as well as the lighting pattern of the operation lamp which flashes with the timer lamp.(For details, refer to Error diagnostic method.)

2. OUTDOOR UNIT

2-1 Defrost operation (AE-X08CR/X10CR/13CR)

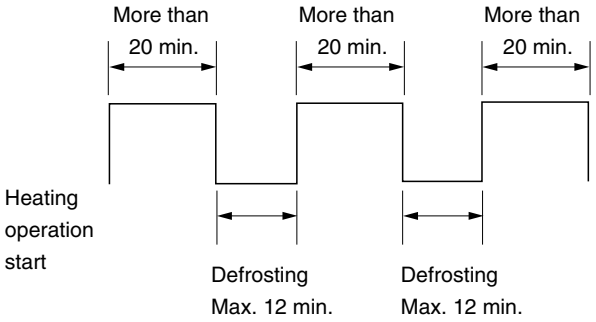
(1) Overview

Defrosting begins during heating if the conditions for compressor operation time and outdoor heat exchanger temperature are met.
When defrosting begins, the indoor and outdoor fans stop. Defrosting stops when the temperature of the outdoor heat exchanger goes above approximately 5˚C or defrosting time exceeds 13 minutes.



2) Defrosting

If the compressor operation time is more than 20 minutes in the heating mode and the outdoor air temperature and outdoor heat exchange temperature satisfy the defrosting conditions, the defrosting operation is started.
When the outdoor sheat-exchanger temperature reaches approx. 7°C or above or when the defrosting time exceeds 13 minutes, the defrosting operation is quit.



(3) During defrosting

When defrosting begins, the compressor stops. Approximately 1 minute later, the compressor reactivates in the refrigeration cycle, and the outdoor heat exchanger is defrosted.
Each mode is as follows:
The outdoor fan is stopped
The operating frequency is as shown in the table below The indoor fan is stopped.
The 4-way valve is OFF.

for 5 minutes	after 5 minutes
62.500	62.500

(4) Defrost stop
When defrosting time exceeds 13 minutes When the temperature of the outdoor heat exchanger rises above approximately 7˚C Defrost stop is determined by either of the above conditions, and the compressor is stopped. At the same time, the outdoor fan go ON. The compressor is reactivated in the heating cycle 1 minute after it was stopped, and normal control resumes.

2-2 Frequency control

(1) AC current peak control

Set value	
Cool	Heat
6.2A	6.7A

(2) Control for prevention of indoor heat exchanger overheating.
If the temperature of the indoor heat exchanger exceeds the overheating prevention line 1 or 2 during heating, the operating frequency is lowered by approximately 5 to 10 Hz. After that, the frequency is lowered by approximately 5Hz once every 60 seconds or 10 Hz once every 60 seconds. When the temperature of the indoor heat exchanger goes below the overheating prevention line 1, the frequency is raised by approximately 5 Hz once every 60 seconds, and normal operation is restored.
If the frequency is lowered to minimum frequency without the temperature of the outdoor heat exchanger decreasing and this condition lasts for 1 minute, the compressor will be stopped.

Operating frequency	Overheating prevention line 1 (Lower 5Hz)								
		130Hz ~	112Hz ~ 130Hz	105Hz ~ 112Hz	97Hz ~ 105Hz	50Hz ~ 97Hz	43Hz ~ 50Hz	37Hz ~ 43Hz	~ 37Hz
During normal operation	[˚C]	44.84	44.84	51.87	53.29	54.26	53.29	52.34	44.84
During full power operation	[˚C]	47.39	47.39	50.95	54.26	57.27	55.74	54.75	46.53

Operating frequency	Overheating prevention line 2 (Lower 10Hz)								
		130Hz ~	112Hz ~ 130Hz	105Hz ~ 112Hz	97Hz ~ 105Hz	50Hz ~ 97Hz	43Hz ~ 50Hz	37Hz ~ 43Hz	~ 37Hz
During normal operation	[˚C]	49.59	49.59	53.29	56.25	57.27	56.25	55.24	47.39
During full power operation	[˚C]	51.87	51.87	53.74	58.85	59.94	58.85	57.27	49.14

(3) Control for prevention of outdoor heat exchanger overheating.
If the temperature of the outdoor heat exchanger exceeds the overheating prevention line 1 or 2 during cooling, the operating frequency is lowered by approximately 5 to 15 Hz.
After that, the frequency is lowered by approximately 5 once every 60 seconds or approximately 15Hz once every 60 seconds. When the temperature of the outdoor heat exchanger goes below the overheating prevention clear line, the frequency is raised by approximately 5 Hz once every 60 seconds, and normal operation is restored. If the frequency is lowered to minimum frequency without the temperature of the outdoor heat exchanger decreasing and this condition lasts for 1 minute, the compressor will be stopped.

Overheating prevention line 1	55˚C	Lower 5Hz once every 60 seconds
Overheating prevention line 2	57˚C	Lower 15Hz once every 60 seconds
Overheating prevention clear line	54˚C	

4) Control for prevention of discharge overheating
If the discharge temperature exceeds approximately 105°C during compressor operation, the operating frequency is lowered by approximately 5 Hz. After that, the frequency is lowered by approximately 5 Hz once every 60 seconds. When the discharge temperature goes below approximately 104°C, the frequency is raised by approximately 5 Hz once every 60 seconds, and normal operation is restored.
If the frequency is lowered to minimum frequencywithout the discharge temperature decreasing and this condition lasts for 1 minute, the compressor will be stopped.

(5) Control for prevention of indoor heat exchanger freezing
If the temperature of the indoor heat exchanger goes below approximately 5°C during cooling(only Full power operation), the operating frequency is lowered by approximately 5 Hz. After that, the frequency is lowered by approximately 5 Hz once every 60 seconds. When the temperature of the indoor heat exchanger rises above approximately 5°C, the frequency is raised by approximately 5 Hz once every 60 seconds, and normal operation is restored.
If the temperature of the indoor heat exchanger goes down to approximately 0°C and this condition continues for 4 minutes, the compressor is stopped.
When the temperature rises above approximately 2˚C, normal operation is restored.

2-3 Overcurrent protection

(1) AC overcurrent detection

To protect against overcurrent due to sudden changes in load, the compressor is stopped if the set value AC : 12.5A is exceeded in the AC section. In this case, the outdoor fan does not stop, and 170 seconds after operation is stopped, another try will be made. Three retries are allowed. On the fourth retry, a complete stop request signal is sent to the indoor unit, and the outdoor unit will remain stopped until reset is performed. At this time, the 3-minutes delay for control of the outdoor unit will not function; therefore, do not cancel by removing the plug and cutting the power.

(2) DC overcurrent detection

To protect against overcurrent due to sudden changes in load, the compressor is stopped if the set value DC : 23A) is exceeded in the DC section. In this case, the outdoor fan does not stop, and 170 seconds after operation is stopped, another try will be made. Seven retries are allowed. On the eight retry, a complete stop request signal is sent to the indoor unit, and the outdoor unit will remain stopped until reset is performed. At this time, the 3-minutes delay for control of the outdoor unit will not function; therefore, do not cancel by removing the plug and cutting the power.

2-4 Compressor protector control

If the temperature of the compressor chamber exceeds 114°C, the compressor is stopped. In this case, the outdoor fan does not stop, and when the compressor chamber temperature decreases to 100°C three minutes after operation is stopped, another try will be made. Three retries are allowed. On the fourth retry, a complete stop request signal is sent to the indoor unit, and the outdoor unit will remain stopped until reset is performed. At this time, the 3-minute delay for control of the outdoor unit will not function; therefore, do not cancel by removing the plug and cutting the power.

2-5 Power transistor module protector

If the temperature of the heat-sink exceeds 90 °C, the compressor is stopped.
In this case, the outdoor fan does not stop, and when the temperature of the heat-sink decreases to 80 °C 170 seconds after operation is stopped, another try will be made.
Three retries are allowed. On the fourth retry, a complete stop request signal is sent to the indoor unit, and the outdoor unit will remain stopped until reset is performed. At this time, the 3-minutes delay for control of the outdoor unit will not function; therefore, do not cancel by removing the plug and cutting the power.
Also if the temperature of the heat-sink exceeds 100˚C, a complete stop request signal is sent to the inddor unit, and the outdoor unit will remain stopped until reset is performed. At this time, the 3-minutes delay for control of the outdoor unit will not function ; therefore, do not cancel by removing the plug and cutting the power.

2-6 Power factor module

If a voltage error (over 420V) is detected at power factor module output voltage, 170seconds the compressor is stopped.
In this case, the outdoor fan does not stop, and 170 seconds after operation is stopped, another try will be made.
Three retries are allowed. On the fourth retry, a complete stop request signal is sent to the indoor unit, and the outdoor unit will remain stopped until reset is performed. At this time, the 3-minute delay for control of the outdoor unit will not function; therefore, do not cancel by removing the plug and cutting the power.

2-7 Serial signals

(1) Serial signals consist of all 96-bit signals.
(2) If the outdoor unit does not receive a serial signal, it will stop approximately 30 seconds later. Note that this is true only of normal operation; in test mode, it does not stop and operation takes place based on the test mode commands.

2-8 Rotation abnormal detection of compressor rotation

If the position detection cannot be performed during feedback operation of compressor operation, operation of the compressor stopped.
In this case, the outdoor fan does not stop, and 170 seconds after operation is stopped, another try will be made.
Seventh retries are allowed. On the eight retry, a complete stop request signal is sent to the inddor unit, and the outdoor unit will remain stopped until reset is performed. At this time, the 3-minutes delay for control of the outdoor unit will not function ; therefore, do not cancel by removing the plug and cutting the power.

FUNCTION AND OPERATION OF PROTECTIVE PROCEDURES

NO	Function	Operation				Self diagnostic display	
		Description	Detection time	Restart condition	Restart times	Indoor	Outdoor
1	Indoor fan lock Indoor fan rpm error	Stops operation if no rotation pulse signal is input from the indoor fan motor for one minute. Stops operation if the rotation pulse signal from the indoor fan indicates low rpm (approximately 300 rpm or less).	When indoor fan is rotating	Operation OFF	No limit	Yes	No
2	Indoor freezing guard	Lowers the operating frequency if the temperature of the indoor heat exchanger goes below 5°C during cooling. Stops the compressor if the temperature stays below 0°C for 4 minutes.	During cooling and dry	Automatically restarts when the exchange temperature rises above the freezing prevention temperature (above 2°C)	No limit	No	No
3	Indoor overheating control	Lowers the operating frequency if the temperature of the indoor heat exchanger rises above the overheating temperature during heating. Stops the compressor if the temperature stays above the overheating temperature for 1 minute at minimum frequency or less. Set values for overheating temperature During normal operation: 45°C to 54°C During full power operation: 47°C to 58°C	During heating	Automatically restarts when the exchange temperature goes below the overheating temperature.	No limit	No	No
4	DC overcurrent	Stops the compressor if a current of approximately 23A or more flows in the power transistor module.	During compressor operation	Automatically restarts after safety time (170 seconds)	8times	Yes	Yes
5	AC overcurrent	Lowers the operating frequency if the compressor AC current exceeds set value(※).Show "2-2(1)AC peak control" Stops the compressor if the current exceeds at 40Hz or less set value(※).	During compressor operation	Automatically restarts after safety time (170 seconds)	4 times	Yes	Yes
6	Compressor overheating control	Lowers the operating frequency if the temperature of the compressor chamber thermistor (TH1) rises above 105°C. Stops the compressor if the thermistor stays above 105°C for 1 minutes at minimum frequency or less.	During compressor operation	Automatically restarts after safety time (170 seconds)	No limit	No	No
7	Compressor high temperature error	Stops the compressor if the compressor chamber thermistor is above 114°C. (Or when TH1 shorts)	During operation	Automatically restarts when thermistor (TH1) temperature falls below 100°C (approximately 30 minutes)	4 times	Yes	Yes

(※)

Set value	Cool	6.2A
	Heat	6.7A

NO	Function	Operation				Self diagnostic display	
		Description	Detection time	Restart condition	Restart times	Indoor	Outdoor
8	Outdoor heat exchanger overheating control	Lowers the operating frequency if the temperature of the outdoor heat exchanger rises above 55°C during cooling. Stops the compressor if the temperature stays above 55°C for 1 minute at minumum frequency.	During compressor operation	Automatically restarts after safety time (170 seconds)	No limit	No	No
9	Outdoor thermistor short	Stops the compressor if an outdoor thermistor (excluding TH1) shorts.	When compressor is activated	Automatically restarts after safety time (170 seconds)	4 times	Yes	Yes
10	Outdoor thermistor open	Stops the compressor if the circuit of an outdoor thermistor breaks.	When compressor is activated	Automatically restarts after safety time (170 seconds)	4 times	Yes	Yes
11	AC abnormal current error	Stops the compressor if the operating frequency is above 50 Hz and the compressor current is below 1.0 A.	During compressor operation	Automatically restarts after safety time (170 seconds)	4 times	Yes	Yes
12	Serial signal error	Turns the compressor relay off if the indoor unit does not receive a serial signal from the outdoor unit for 8 minutes.	During operation	Automatically restarts less than 8 minutes after operation stops	No limit	Yes	—
		Stops the compressor if the outdoor unit does not receive a serial signal from the indoor unit for 30 seconds.	During operation	Restarts after reception of serial signal	No limit	—	Yes
13	Power factor module (Active filter) error	When power factor module error input is detected.	During compressor operation	Automatically restarts after safety time (170 seconds)	4 times	Yes	Yes
14	Rotation error of the compressor	When abnormalities occur to a position detected signal.	Under feedback operation of compressor operation	Automatically restart after safety time (170 seconds)	8 times	Yes	Yes
15	Open circuit of the power module (IPM) heat-sink thermistor	Stops the compressor if the circuit of the heat-sink thermistor.	When compressor is activated	Automatically restarts after safety time (170 seconds)	4 times	Yes	Yes
16	Overheat of the power module (IPM) or short circuit of the power module (IPM) heat-sink thermistor	Stops the compressor if the temperature of the power module is (IPM) is exceeds 90˚C. Also stops the compressor if the heat-sink thermistor shorts.	During compressor operation	Automatically restarts after safety time (170 seconds)	4 times	Yes	Yes

BREAK DOWN DIAGNOSIS PROCEDURE

Self-diagnostic procedure using display mode
If the timer lamp blinks during operation, the problem can be diagnosed using the following table.

● : Blinks at 2-second intervals　× : OFF　○ : ON　◎ : Blinks 3 times at 0.2-second intervals

Condition of indoor and outdoor unit	Display by indoor unit operation lamp Displayed in a pattern which comes on at the same time as the timer lamp →○ × ○ × ○ × ○ × ○→ 4 seconds off	Display by outdoor unit lamp LED 1	Diagnosis	What to check, procedure	Solution
Normal	× × × × × 8	●	Normal	———	———
The error of outdoor unit	× × × ○ × 2	◎ Twice	Overheat of the compressor error (protector operating) or outdoor compressor thermistor TH1 short	1. Is the discharge outlet of the outdoor unit clogged ? 2. Is the power supply voltage at least 198 V at full power operation ? 3. Check for refrigerant leaks at the tubing connections. 4. Measure the resistance of compressor thermistor TH1 on the outdoor unit (see Figure 3). 5. Measure the resistance of heat exchanger pipe thermistor TH2 on the indoor unit (see Figure 1).	1. Clear the discharge outlet. 2. Assure power supply voltage. 3. Refill to rated amount. 4. Replace the outdoor ther-mistor assembly. 5. Replace the indoor control board assembly or only TH2.
	× × ○ ○ × 6	◎ 3 times	DC overcurrent error	1. Check the circuit in the power transistor module. 2. Is the outdoor fan rotating ?	1. Replace power transistor module
	× × × × ○ 1	◎ 4 times	Short circuit of the outdoor thermistor error	1. Measure the resistance of thermistor TH2 on the outdoor unit (see Figure 3).	1. Replace the outdoor thermistor assembly.
	× × ○ × ○ 5	◎ 5 times	Open circuit of the outdoor thermistor error	1. Is the connector of the outdoor unit thermistors well attached ? (see Figure 3). 2. Measure the resistance of thermistors TH1 and TH2 on the outdoor unit (see Figure 3).	1. Reattach. 2. Replace the outdoor thermistor assembly.
	× × × ○ ○ 3	◎ 6 times	AC abnormal current error	1. Can voltage be detected at the current transformer on the outdoor unit control board?	1. Replace the outdoor control board assembly (Current transformer wire break.)
	× × ○ ○ ○ 7	◎ 7 times	AC overcurrent error	1. Is the discharge outlet of the outdoor unit clogged ?	1. Clear the discharge outlet.
	× ○ ○ ○ × 14	◎ 11 times	Power factor module error	1. CHeck wiring of power factor module.	1. Replace the power factor module.
	× ○ ○ ○ × 13	◎ 9 times	Rotation errot of the compressor	1. Has not if escaped from the compressor CN6 ? 2. Is the power supplied of 15V and 6V supplied to the IPM PWB.	1. Reattach. 2. Reattach CN101 and CN102, otherwise replace power transistor module assembly or outdoor control board assembly.
	× ○ × × × 8	◎ 14 times	Open circuit of the heatsink thermistor.	1. Are the connectors of the heatsink thermistor in outdoor unit well attached ? 2. Measure the resistance of thermistor TH6 on the heatsink. (See Figure 3).	1. Reattach. 2. Replace the heatsink thermistor.
	× ○ × ○ × 10	◎ 13 times	Overheat of the power module or short circuit of the heatsink thermistor.	1. Measure the resistance of heatsink thermistor TH6 on the heatsink in outdoor unit. 2. Check rotation of the fan motor in outdoor unit. 3. Is the power supply voltage at least 198V at full power operation ?	1. Replace the heatsink thermistor. 2. Reattach CN3, otherwise replace the fan motor of outdoor unit. 3. Assure power supply voltage.

● : Blinks at 2-second intervals　× : OFF　○ : ON　◎ : Blinks 3 times at 0.2-second intervals

Condition of indoor and outdoor unit	Display by indoor unit operation lamp Displayed in a pattern which comes on at the same time as the timer lamp →○ × ○ × ○ × ○ × ○→ 4 seconds off		Display by outdoor unit lamp LED 1	Diagnosis	What to check, procedure	Solution
The error of indoor unit	○ × × ○ ○	19	×	Indoor fan out of order	1. Is the fan motor locked ? 2. Is the wiring connector firmly fitted ? 3. Is the rotation pulse signal applied to the motor ?	1. Replace fan motor 2. Reattach. 3. Replace the indoor control board assembly.
	○ × × ○ ×	18	○	Serial short	1. Check the wiring between units.	1. Rewire.
	○ × × × ○	17	○	Serial open	1. Check the wiring between units.	1. Rewire.
			×	Outdoor power supply does't turn on. Wiring mistake.	1. Check the wiring between units. 2. Check the fuse in the outdoor unit. 3. Indoor control board. 4. Outdoor control board.	1. Rewire. 2. Replace the fuse, replace the outdoor board assembly. 3. Replace the board. 4. Replace the board.

Note: 1. Normal : Only the timer lamp blinks. Error : Displayed by blinking of run lamp (above table).
2. If the power plug is removed from the outlet or the breaker is switched to "OFF", the self-diagnostic memory will be erased.
3. Example of outdoor unit LED 1 blinking :

Figure 1 Temperature properties of indoor thermistors

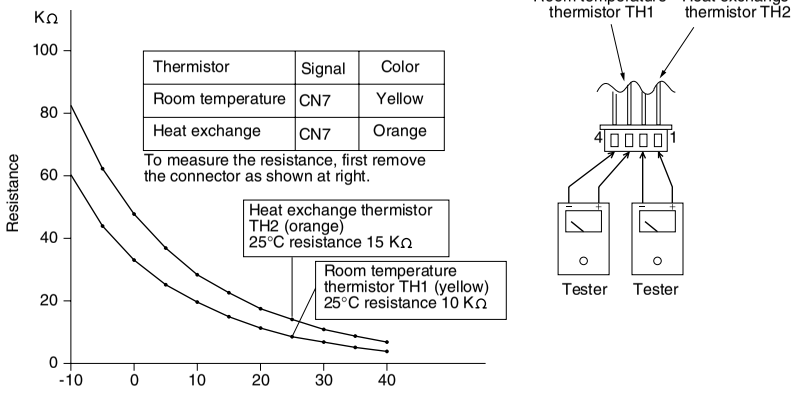
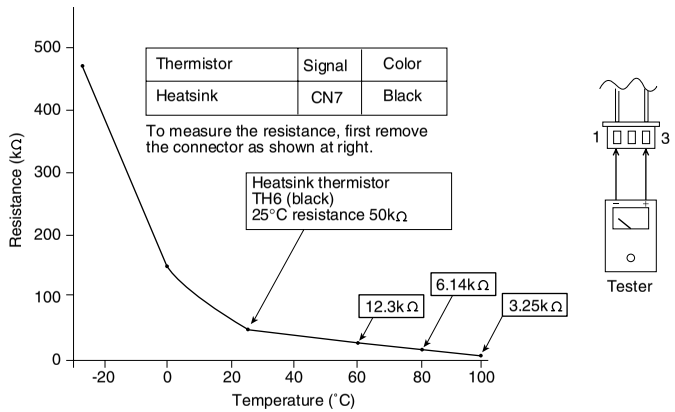
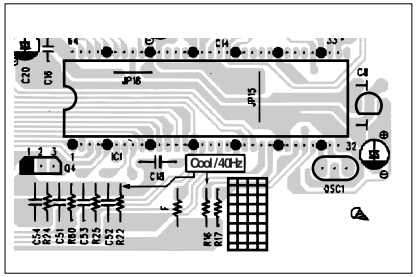


Figure 2 Temperature properties of heatsink thermistors



Cautions when attaching or removing the board

When operating only the outdoor unit (cooling 40 Hz fixed mode) To make only the outdoor unit run in cooling mode, short the places marked with arrows below with an adaptor, and apply a voltage of 220 ~ 240 V AC to 1 and N on the terminal board.
(Avoid operating the outdoor unit alone for long periods of time.)



Adaptor
(R16)
(R22)
(GND)

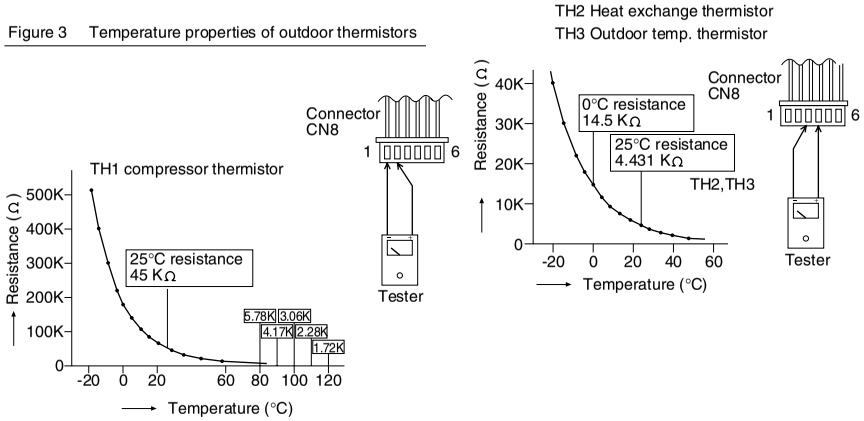
Microcomputer terminal	Input signal
Pin No. 27	0
Pin No. 28	1

To Outdoor control board

0 ····· Low input

1 ····· High input

Figure 3 Temperature properties of outdoor thermistors



Thermistor	No.	Connector	Color
Compressor thermistor	TH1	No. 1 to 2	Red
Heat exchanger pipe thermistor	TH2	No. 3 to 4	Orange
Outdoor temp. thermistor	TH3	No. 5 to 6	Green

To measure the resistance, first remove the connector from the board.

REFRIGERATION CYCLE

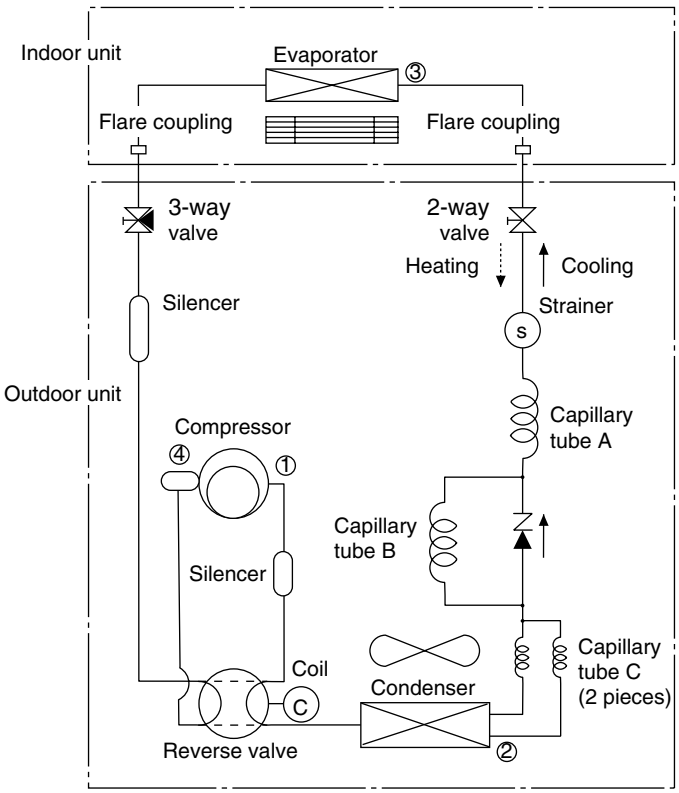


Figure R-1. Refrigeration Cycle for INDOOR UNIT

Standard conditions:

	Indoor side		Outdoor side	
	Dry-bulb Temp. (˚C)	Relative Humidity (%)	Dry-bulb Temp. (˚C)	Relative Humidity (%)
Cooling	27	47	35	40
Heating	20	—	7	87

Temperature at each part and pressure in 3-way valve

Operation mode	Cool (Max.)	Heat (Max.)	Cool	Heat
Hz / No.	80	more than 80	40 settle	50 settle
①	82˚C	78˚C	65˚C	59˚C
②	45˚C	1˚C	40˚C	2˚C
③	11˚C	38˚C	15˚C	32˚C
④	8˚C	6˚C	12˚C	4˚C
3-way valve pressure (MPaG)	0.85	2.43	1.10	2.00

Dimension of Capillary tube

Model	O.D	I.D	L
Capillary tube A	ø2.7	ø1.5	550
Capillary tube B	ø2.7	ø1.6	300
Capillary tube C	ø2.7	ø1.5	150

PERFORMANCE CURVES

NOTE: 1) Indoor fan speed: Hi
2) Vertical adjustment louver "45˚", Horizontal adjustment louver "front"
3) Indoor air temp. : Cooling 27˚C, Heating 20˚C

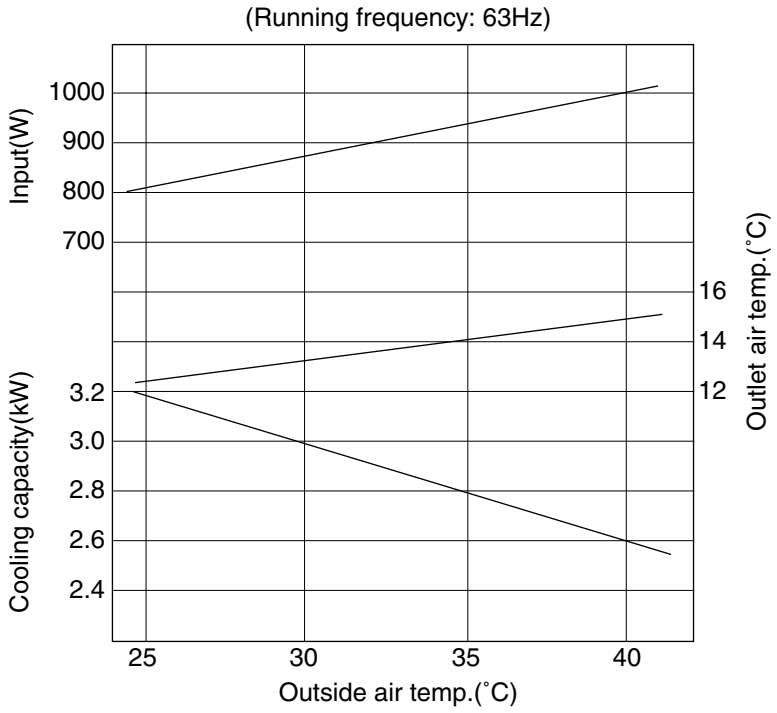


Figure P-1. At Cooling

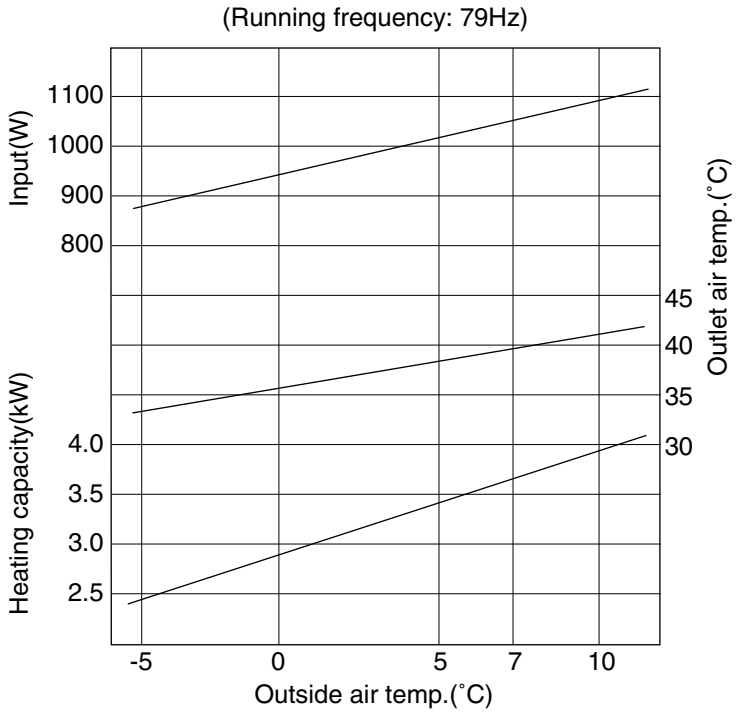
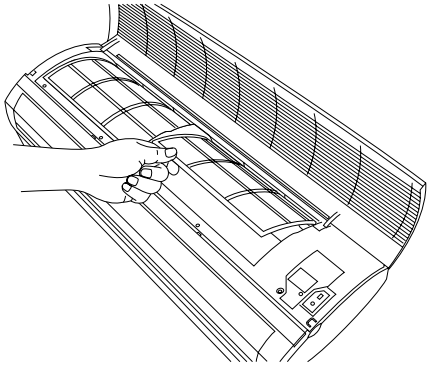


Figure P-2. At Heating

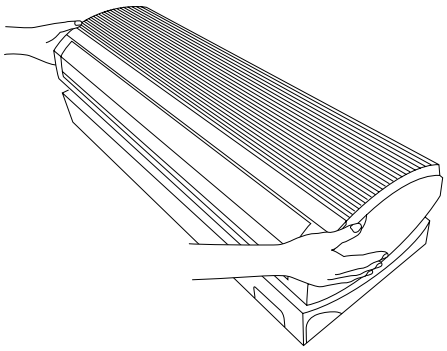
DISASSEMBLING PROCEDURE

FOR INDOOR UNIT

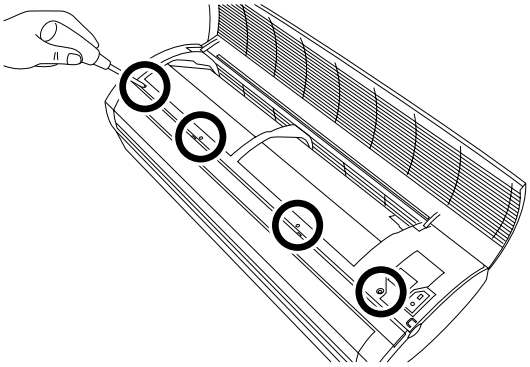
CAUTION : DISCONNECT THE UNIT FROM THE POWER SUPPLY BEFORE ANY SERVICING



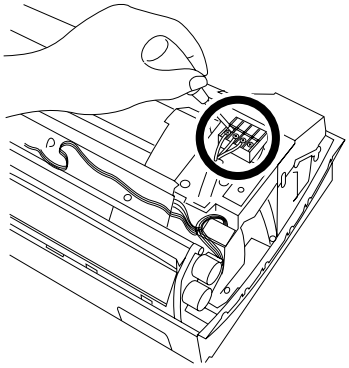
1. Open the opne panel, and remove 2 air filters.



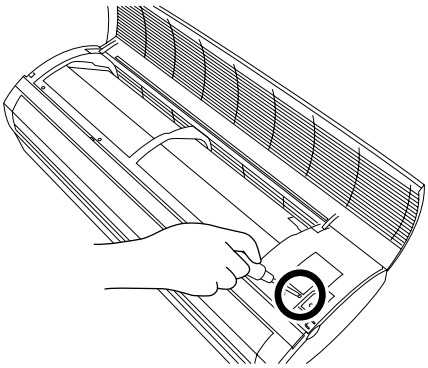
5. Pull the front panel up.



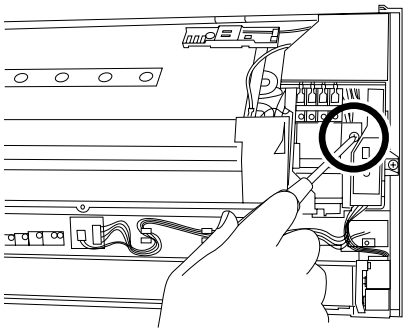
2. Remove 4 screws fixing the front panel.



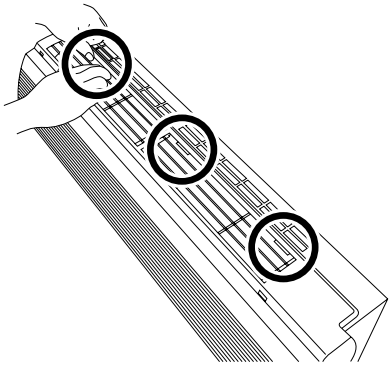
6. Remove the unit-to-unit wiring from the terminal board.



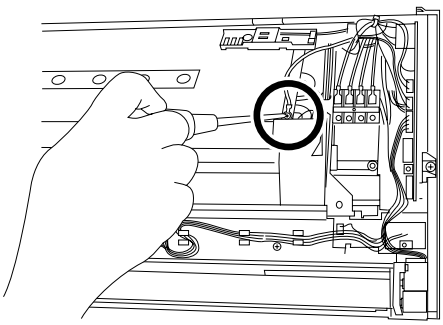
3. Remove the screw fixing the cord clamp.
   Note: During reassembly, install the holder after installing the front panel. This will make it easier to assemble the front panel.



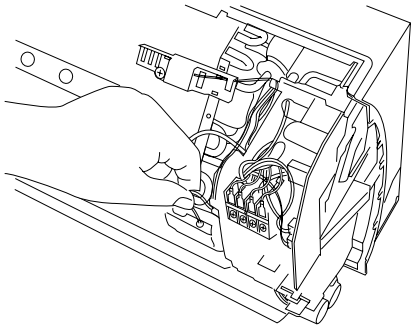
7. Remove a screw fixing the control box cover, and remove it.



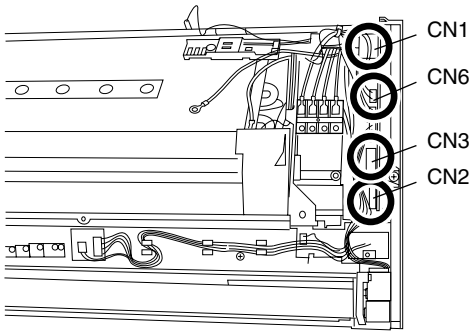
4. Close the open panel. Pushing the nail of the front panel.



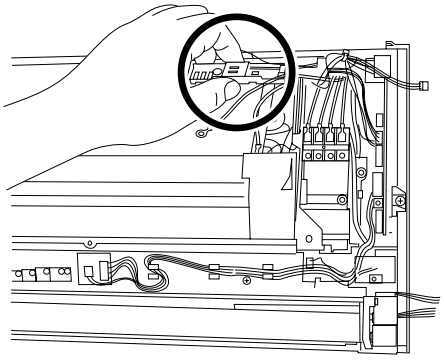
8. Remove a screw fixing the ground wire.
   Note: During reassembly, take care for the direction of the lead wire.



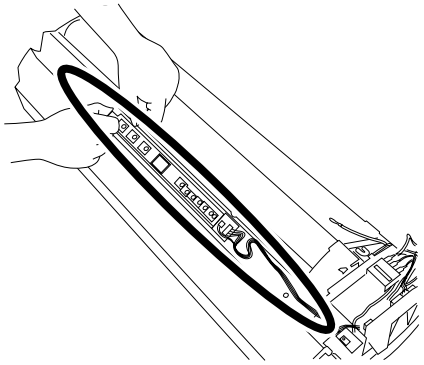
9. Remove the thermistor of the evaporator.



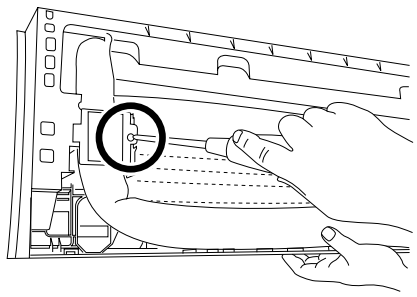
10. Remove 4 connectors.



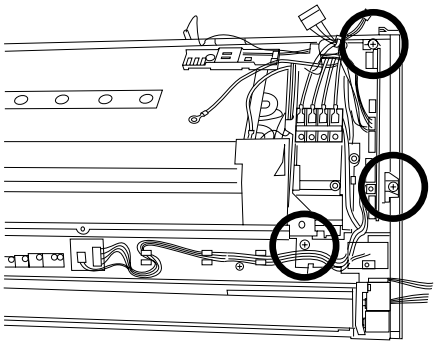
11. Remove the thermistor holder from the evaporator.



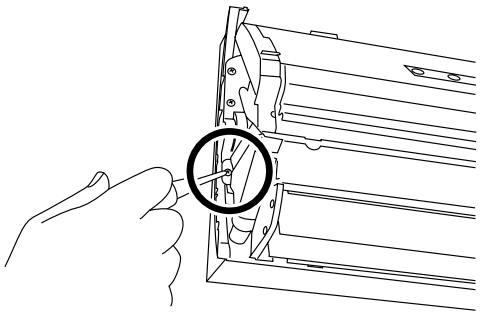
12. Remove the display from the drain pan.



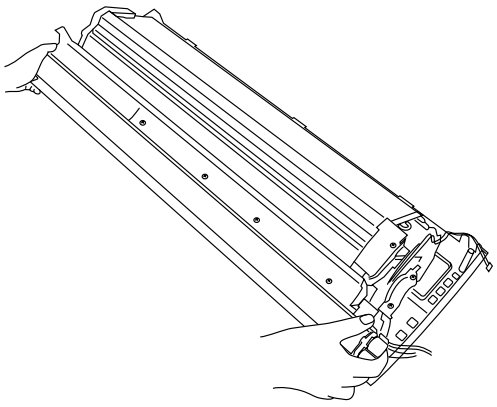
13. Remove the screw fixing the pipe holder.



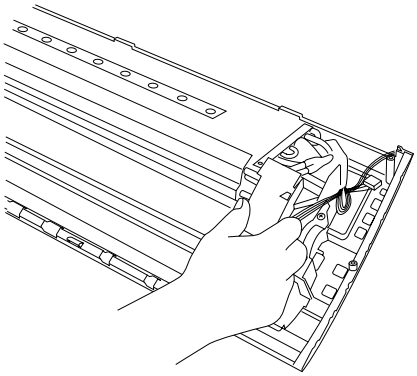
14. Remove 3 screws fixing the control box, and remove the control box.



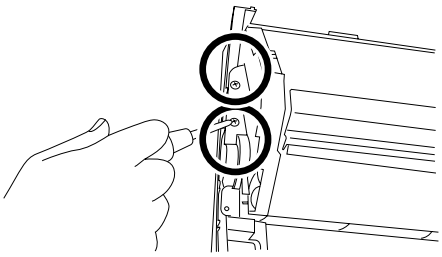
15. Remove a screw fixing the drain pan.

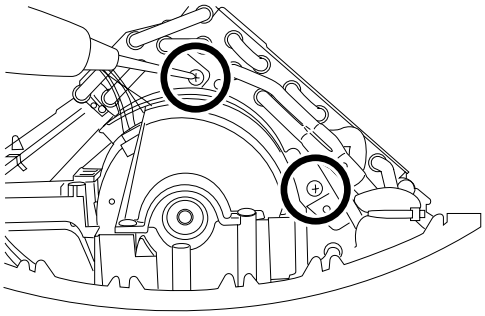


16. Pull drain pan toward you.

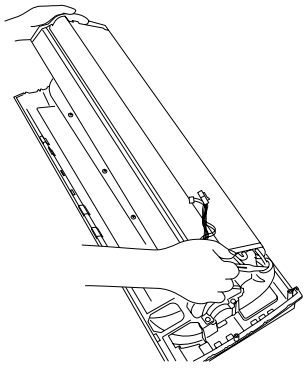


17. Remove the drain cover from the evaporator.
Note: During reassembly, verify that the dew on the pipe is led to the drain pan.

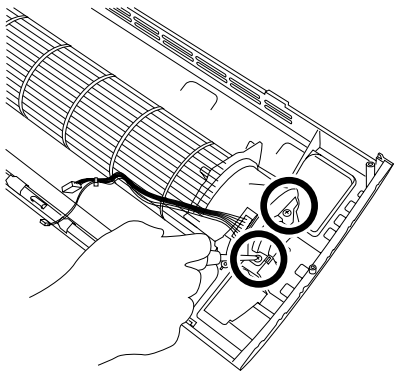


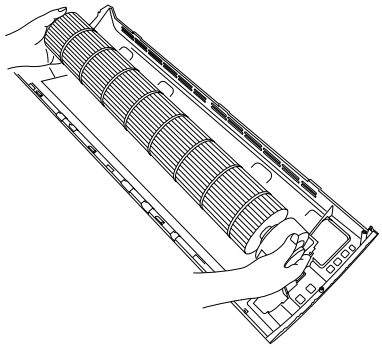


18. Remove 4 screws fixing the evaporator.

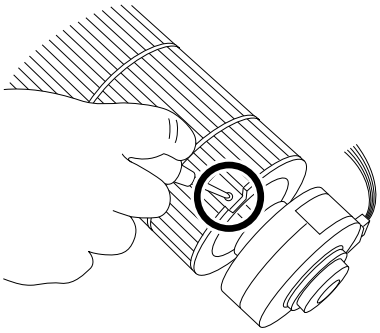


19. Remove the evaporator from the cabinet.





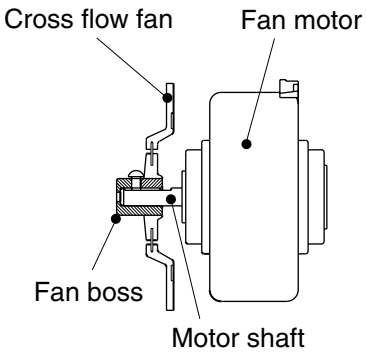
20. Remove 2 screws fixing the motor cover, and pull up the fan.



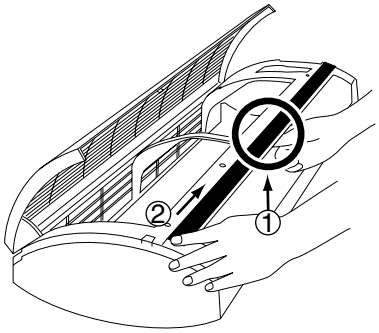
21. Loose a screw fixing fan.

[Cautionary points for assembling the fan]

a. When inserting the motor shaft into the metal fan boss, take care to prevent injuring the inner surface of the metal fan boss.
b. Before fastening the motor shaft and fan, insert the motor shaft into contact with the bottom of the metal fan boss.

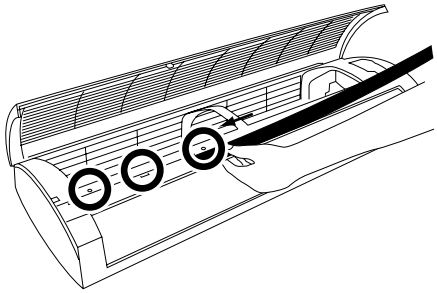


How to remove the display cover

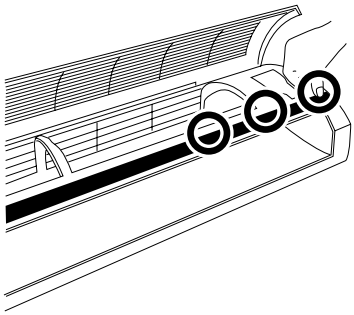


1. Push the center of display cover from the back.
2. Slide the display cover to the right.

How to assemble the display cover

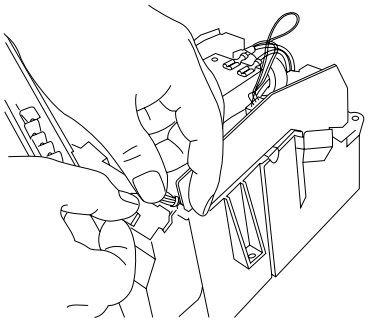


1. Slide the left end of the display cover through 3 hooks on the front panel along the guide from the center of the front panel.

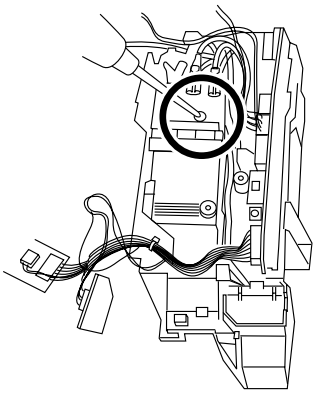


2. After the left half is inseted completely, press the display cover and snap in the 3 hooks on the right.

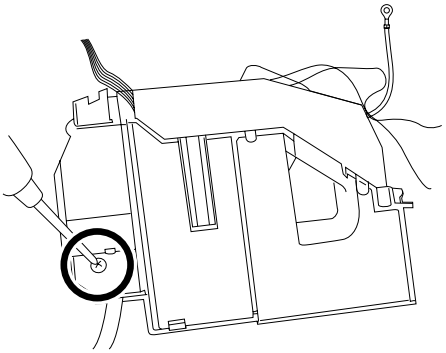
How to remove the control box



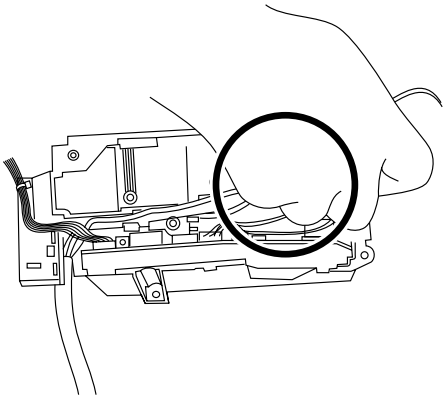
1. Remove the photo detector unit.
   (Press and spread the upper hook, and the photo detector unit will be ready for removal.)



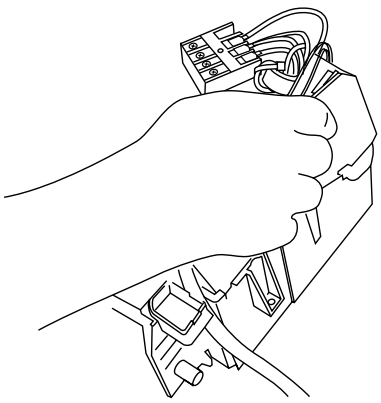
2. Remove the screw fixing the terminal board.



3. Remove a screw fixing the cord holder.

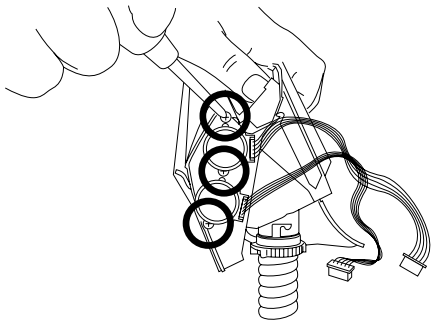


4. Remove 2 screws fixing the board (transformer).

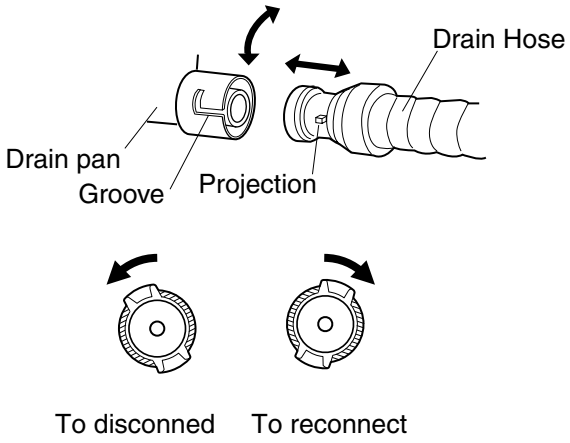


5. Pull the board.

Drain pan and related

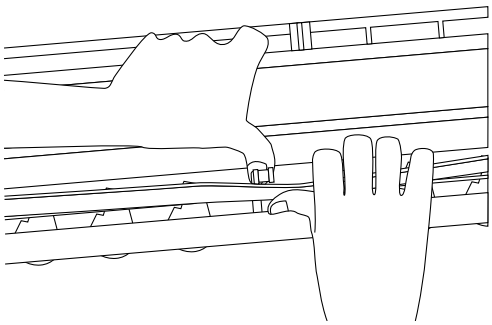


1. Remove 3 screws fixing motors.



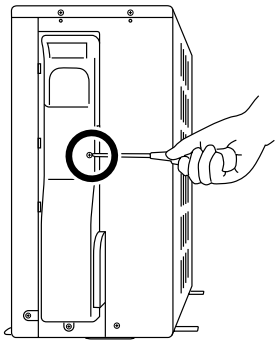
2. Turn the cap area of the drain hose counterclockwise, and remove it from the drain pan.
   During installation, turn the drain hose to the state of the “engagement position”.
   After reinstallation, verify that it is securely fastened.

How to remove the horizontal louver
Slightly pull down the hinge area, defelect thge louver, and unhook it from the hinge. Remove the shaft from each of the left and right sides.

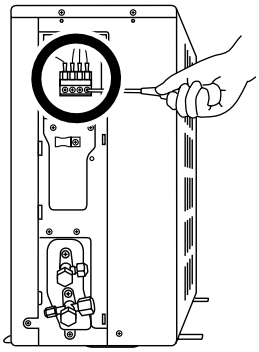


FOR OUTDOOR UNIT

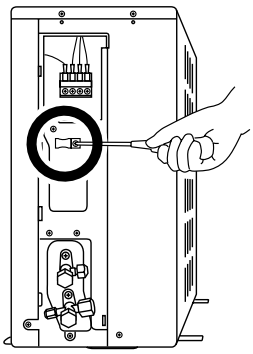
CAUTION : DISCONNECT THE UNIT FROM THE POWER SUPPLY BEFORE ANY SERVICING



1. Loose a screw fixing the side cover.

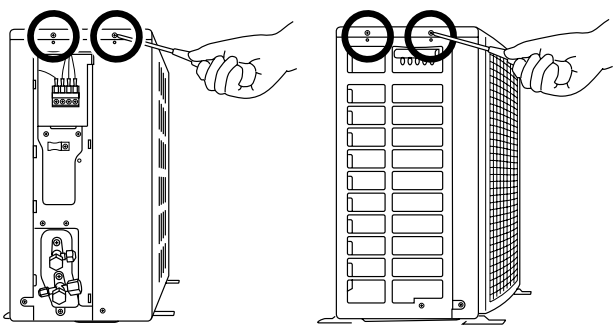


2. Loose the unit to unit cord.



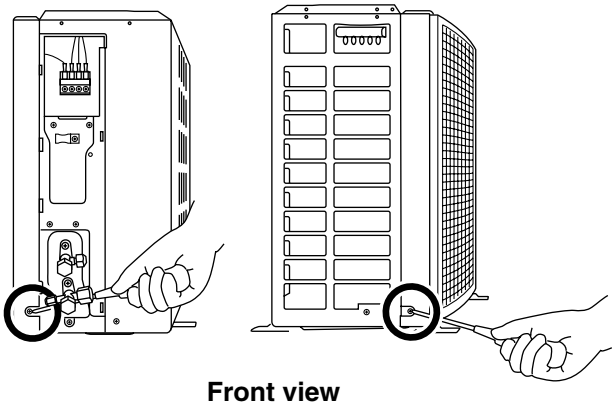
3. Loose a screw fixing the cord clamp.

Right side view **Left side view**

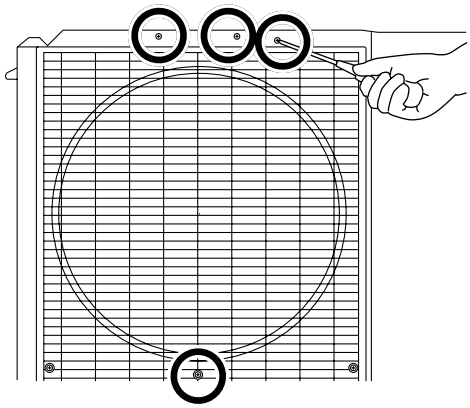


4. Loose 4 screws fixing the top panel.

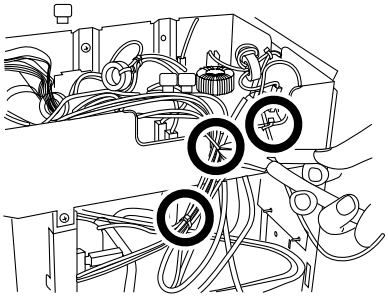
Right side view **Left side view**



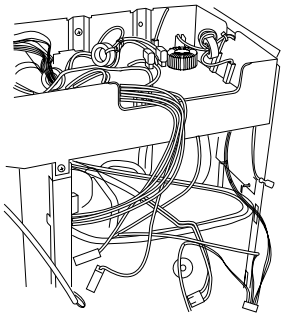
Front view



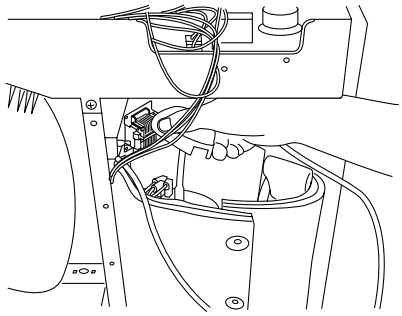
5. Loose 6 screws fixing the front panel.



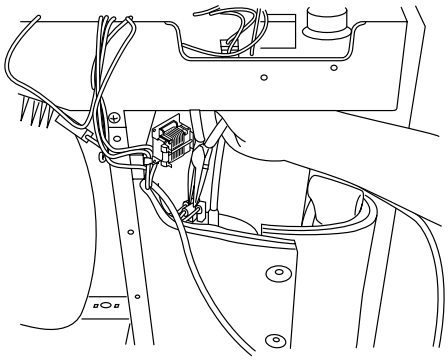
6. Cut 4 nylon bands.



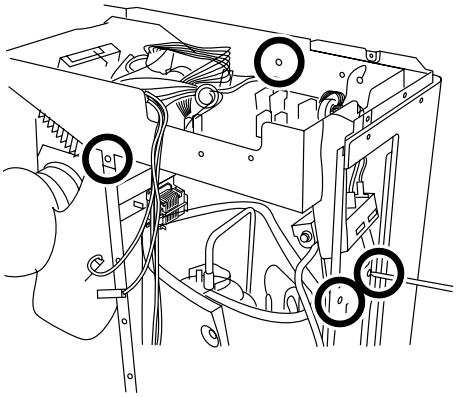
7. Disconnect following connectors and each wire.
   - Choke coil(two terminal)
   - Fan motor
   - Thermistor
   - Reverse valve



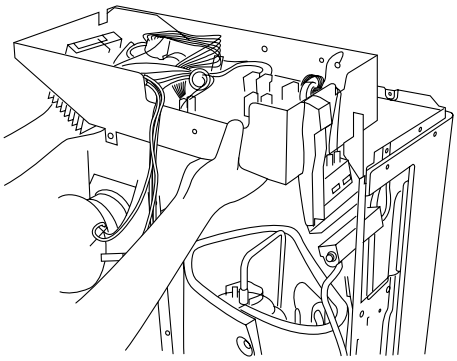
8. Remove the terminal cover of compressor.



9. Remove 3 terminals of compressor..

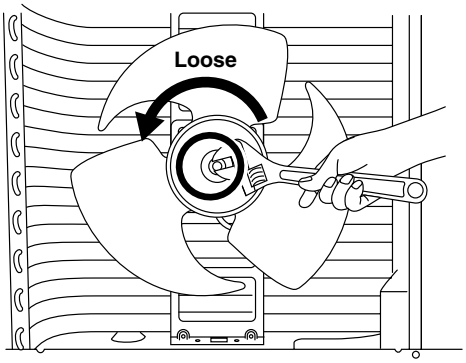


10. Loose 4 screws fixing the control box.

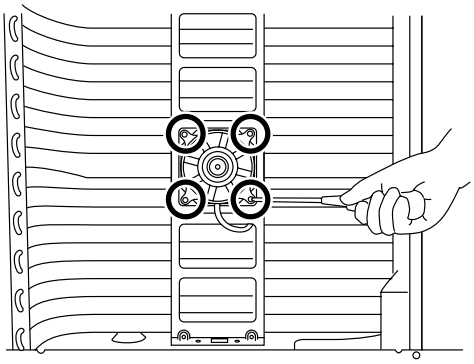


11. Take out the control box.

DISASSEMBLING PROCEDURE OF THE FAN



1. Loose the fan nut and fan can take out.



2. Fan motor is secured by 4 screws.

OPTION

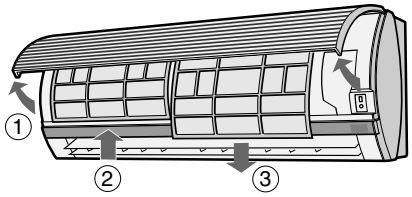
HOW TO REPLACE THE AIR PURIFYING FILTER (AZ-F900B; Electrostatic Type (2-sheet package))

Precautions

- The filters are sealed in a plastic bag to keep thier dust collection effect. Do not open the bag until using the filters. (Otherwise the filters' life may get shorter.)
- Do not expose the filters to direct sunlight.
  (Otherwise they may deteriorate.)

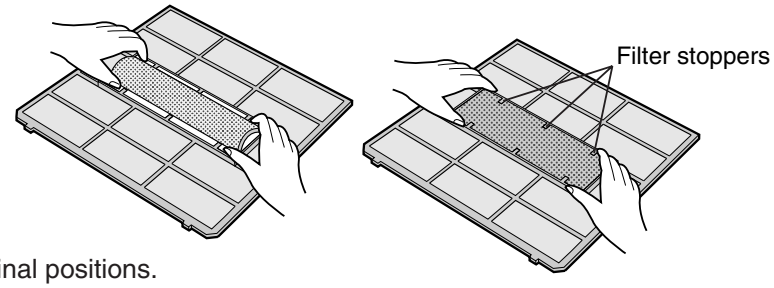
1. REMOVE THE AIR FILTERS.

1) Open the front panel
2) Push the air filter up slightly to unhook them.



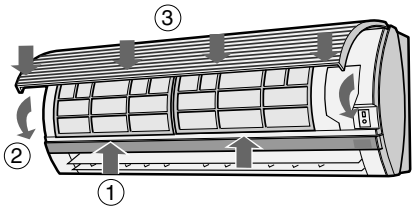
2. CHECK THE AIR PURIFYING FILTERS.

1) Take of the old air purifying filters from the air filters. Snap out in the arrow marked direction.
2) Set the new air purifying filters with filter stopperts located on the air filters.



3. REINSTALL THE AIR FILTERS

1) Reinstall the air filters in the original positions.
2) Close the front panel.
3) Push the center part of the panel firmly to lock it in place.



REPLACEMENT INTERVALS GUIDELINE

Replace the air purifying filters at the intervals of 3-6 months.

The dirty filters are not washable for reuse.
The filters are available at your nearest dealer.

REPLACEMENT PARTS LIST [AY-X10CR-N / AY-X10CR]

REF. NO.	PART NO.	DESCRIPTION	Q'TY	CODE
		CONTROL BOX PARTS		
1- 1	CMOT-A397JBKZ	Fan motor sub assembly	1	BG
1- 2	PGUMSA046JBE0	Damper rubber	1	AD
1- 3	CHLD-A067JBK0	Bearing assembly	1	AL
1- 4	DCHS-A401JBKZ	Cabinet sub assembly	1	BC
1- 5	NFANCA089JBEZ	Cross flow fan	1	BD
1- 6	DSRA-A234JBKZ	Drain pan sub assembly	1	BB
1- 7	CMOTLA915JBEZ	Fan motor	1	BK
1- 8	MJNTPA082JBFA	Louver link	2	AC
1- 9	MLOV-A299JBFA	Vertical louver	12	AC
1-10	MLOV-A297JBFA	Horizontal louver A	1	AK
1-11	MLOV-A298JBFA	Horizontal louver B	1	AK
1-12	QW-VZE022JBZZ	Lead wire (for Fan motor)	1	AM
1-13	LHLD-A197JBFP	Louver holder	2	AX
1-14	NBRG-A026JBFA	Louver bushing	2	AB
1-15	LHLD-A476JBFZ	Display cover	1	AK
1-16	PHOS-A025JBE0	Drain hose	1	AL
1-17	PPACGA010JBE0	O ring	1	AB
1-18	PGID-A097JBFZ	Drain cover	2	AF
1-19	RMOT-A061JBE0	Louver motor	2	AS
1-20	PGUMMA110JBE0	Drain plug	1	AD
1-21	CWAK-C229JBKZ	Front panel assembly	1	BC
1-22	PPLT-A212JBFZ	Side cover R	1	AL
1-23	PPLT-A213JBFZ	Side cover L	1	AL
1-24	PCOV-A687JBRA	Display cover	1	BB
1-25	PFILMA145JBEA	Air filter	2	AL
1-26	DHLD-A010JBKZ	Tube holder assembly	1	AK
1-27	HPNL-A514JBTA	Open panel	1	AQ
1-28	TSPC-E266JBRA	Name label [AY-X10CR-N]	1	AE
1-28	TSPC-E024JBRA	Name label [AY-X10CR]	1	AE
1-30	QW-VZE013JBZZ	Lead wire(upper)	1	AG
1-31	GWAK-A257JBFA	Front panel	1	AX
1-32	PCOV-A614JBFZ	Drain cover	1	AG
1-33	TLABCB612JBRZ	Wiring diagram	1	AE
1-34	QW-VZD893JBZZ	Lead wire (Lower)	1	AG
1-35	LHLD-A303JBFA	Tube cover	1	AD
1-36	PSEL-C125JBEZ	Panel insulator	1	AF
1-37	HDEC-B134JBEZ	Display panel	1	AP
1-38	PFPFPB967JBEZ	Sidecover insulator	1	AC
1-39	PSEL-C055JBEZ	Evaporator seal	1	AC
1-40	PSHE-A126JBE0	Evaporator seal	1	AG
1-41	LSPR-A007JBE0	Seet spring	2	AD
1-42	PSEL-C136JBEZ	Insulator [AY-X10CR/X13CR, AH-X13CR]	1	AC
1-43	PFPFPB962JBEZ	Insulator	1	AC
		CONTROL BOX		
2- 1	RTHM-A300JBE0	Thermistor	1	AP
2- 2	PBOX-A342JBFZ	Control box	1	AQ
2- 3	PBOX-A341JBFZ	Terminal cover	1	AH
2- 4	LHLD-A500JBFZ	Thermistor holder	1	AC
2- 5	PCOV-A300JBF0	Thermo holder cover	1	AB
2- 6	HPNLCA776JBFA	Control box cover	1	AG
2- 7	HPNLCA777JBEA	Control panel	1	AD
2- 8	PCOV-A618JBFA	LED holder	1	AE
2- 9	PCOV-A619JBFA	LED holder B	1	AE
2-10	DPWBFA284JBKZ	Control board unit	1	BQ
2-11	QACC-A158JBE0	Power supply cord	1	AT
2-12	QTANZA002JBZZ	Terminal board (3pin)	1	AN
2-13	QTANZA001JBZZ	Terminal board (4pin)	1	AQ
2-14	PCOV-A609JBWZ	Control box cover	1	AC
2-15	RIC--A025BDE0	IC (IC4, IC5)	2	AE
2-16	VHPGL6ZS27+-6	LED (LED102)	1	AG
2-17	VHPSL326422-6	LED (LED121)	1	AP
2-18	PCOV-A611JBWZ	Control box cover	1	AF
2-19	PCOV-A610JBWZ	Terminal cover	1	AE
2-20	VHLGPIU28RR-1	Photo detector unit (IC201)	1	AK
2-21	QFS-GA027JBE0	Fuse 3A 250V (WPE1)	1	AD
2-22	VHIKID65783-1	IC (IC6)	1	AK
2-23	RIC--A022BDE0	IC (IC3)	1	AE
2-24	VHIBR24C01A-6	IC (IC8)	1	AF
2-25	RH-TZA098JBE0	Transistor (Q1, Q2)	2	AB
2-26	RH-VZA020JBE0	Varistor (CNR1)	1	AE
2-27	RH-VXA002JBZZ	Varistor (NR1)	1	AF
2-28	RH-IZA149JBE0	IC (IC2)	1	AE
2-29	VHPGL6ZE27+-6	LED (LED103 - 111)	9	AG

REF. NO.	PART NO.	DESCRIPTION	Q'TY	CODE
2-30	RRLYJA004JBE0	Relay (RY1)	1	AS
2-31	RTRN-A287JBZZ	Transformer (TRANS 1)	1	AT
2-32	VHPGL6ZR27+-6	LED (LED101)	1	AF
2-33	VHRPC817X7/1BS	Photo coupler (PC1)	1	AD
2-34	VHRPC853H//-6	Photo coupler (PC2)	1	AG
2-35	VHRS201D01/-6	Solid state relay (SSR1)	1	AK
2-36	VHD1SR139-6-1	Diode (D7-D9)	3	AB
2-37	VHD1SR35-4A-1	Diode (D1-D5)	5	AC
2-38	VHEHZ24-2//-1	Zenner diode (ZD1)	1	AB

CYCLE PARTS

3- 1	CPIPCA735JBKZ	Tube assembly	1	BH
3- 2	PSEN-A029JBKZ	Flare nut assembly (1/4")	1	AK
3- 3	PSEN-A030JBKZ	Flare nut assembly (3/8")	1	AL
3- 4	PVLV-0341JBE0	Flare union (1/4")	1	AG
3- 5	PVLV-0342JBE0	Flare union (3/8")	1	AH
3- 6	DEVA-A128JBKZ	Evaporator sub assembly	1	BT

ACCESSORY PARTS

4- 1	CRMC-A528JBEZ	Remote control	1	BB
4- 2	UBATUA027JBE0	Battery pack	1	AE
4- 3	LHLD-A477JBFA	Cord holder(for covering the terminal board of indoor unit)	1	AE
4- 4	XTTSD40P16000	Tapping screw (for fixing the cord holder)	1	AA
4- 5	LX-NZA207JBEZ	Special nut (for fixing long screw steadily)	9	AE
4- 6	LPFT-A029JBF0	Drain joint	1	AD
4- 7	PPLTNA058JBWZ	Mounting angle	1	AS
4- 8	XTTSD45P30000	Long screw	8	AA
4- 9	TINSEA296JBRZ	Operation manual	1	AM
4-10	TINS-A706JBRZ	Installation manual	1	AE
4-11	TINS-A707JBRZ	Installation manual	1	AE
4-12	LX-BZA106JBE0	Special screw (for hanging remote controller)	1	AE

SCREWS

5- 1	LX-BZA075JBE0	Special screw (for earth)	1	AA

PACKING PARTS

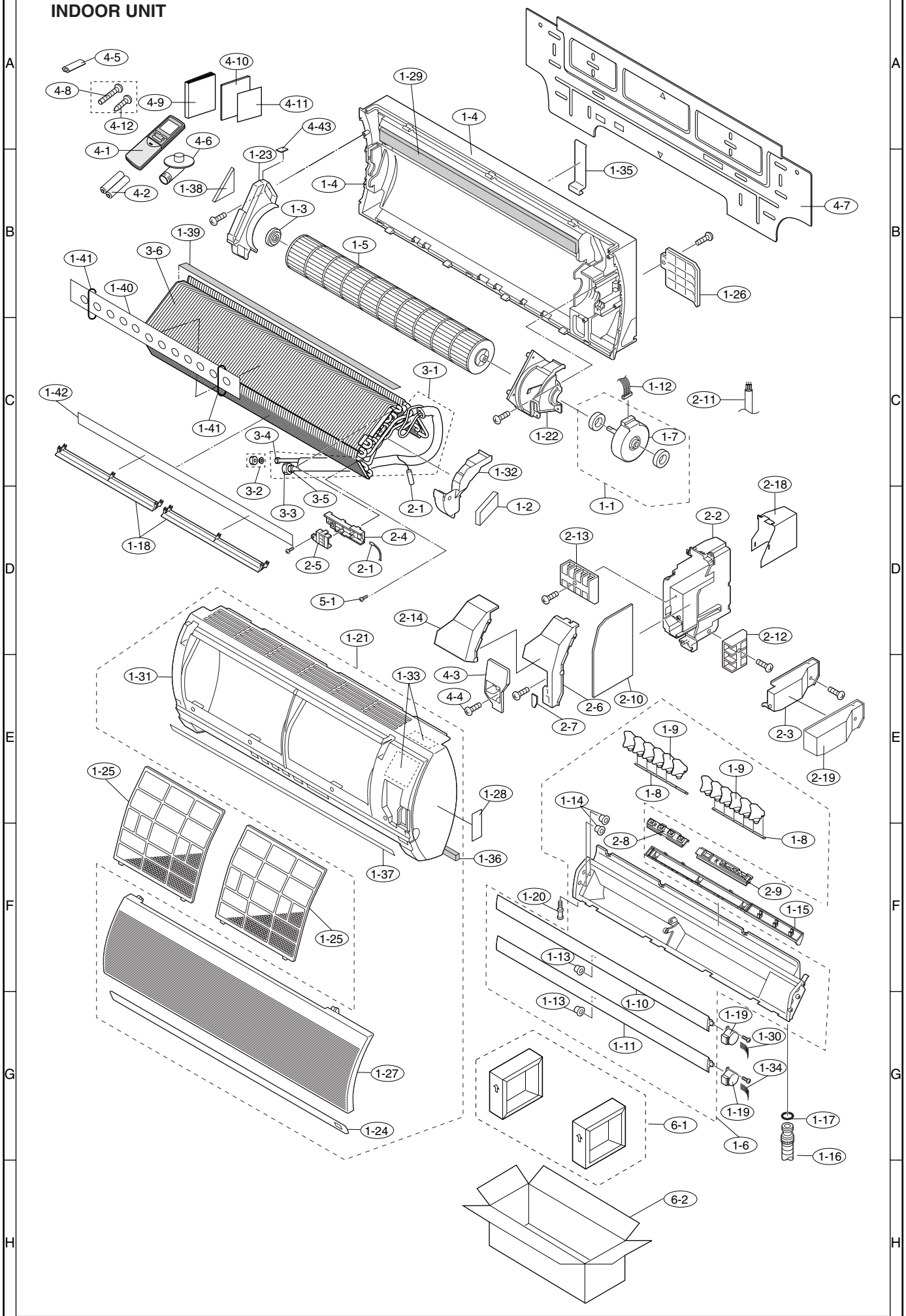
6- 1	CPADBA038JBKZ	Packing pad assembly	2	AK
6- 2	SPAKCB168JBEZ	Packing case [AY-X10CR-N]	1	AR
6- 2	SPAKCA947JBEZ	Packing case [AY-X10CR]	1	AQ

HOW TO ORDER REPLACEMENT PARTS

To have your order filled prompty and correctly, please furnish the following information.

1. MODEL NUMBER 2. REF. NO. 3. PART NO. 4. DESCRIPTION

INDOOR UNIT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REPLACEMENT PARTS LIST [AE-X10CR-N / AE-X10CR]

REF. NO.	PART NO.	DESCRIPTION	Q'TY	CODE
		CONTROL BOX PARTS		
1- 1	CMOTLA902JBEZ	Fan motor	1	BK
1- 2	RTRN-A256JBE0	Current transformer CT1	1	AG
1- 3	DPWBFA252JBKZ	Electric control board	1	BR
1- 4	QTANZA001JBZZ	Terminal board (4P)	1	AQ
1- 5	RIC--A022BDE0	Integrated circuit IC2	1	AA
1- 6	VSKRC245M//-3	Transistor Q1	1	AC
1- 7	VHRPC853H//-6	Photo coupler PC2	1	AG
1- 8	RC-EZA250JBZZ	Capacitor	1	AC
1- 9	RH-DZA087JBE0	Diode bridge	1	AQ
1-10	DPWBFA256JBKZ	IPM board unit	1	BR
1-11	PDAI-A126JBWZ	Terminal plate	1	AE
1-12	RH-TXA003JBZZ	Active filter	1	BS
1-13	RTHM-A022JBE0	Compressor thermistor	1	AN
1-14	RH-HXA019JBZZ	Thermistor	1	AV
1-15	RTRN-A286JBEZ	Choke coil	1	BF
1-16	DBOX-A035JBYZ	Control box	1	AG
1-17	LBND-A042JBE0	Wire fixing band	7	AC
1-18	PSPA-A151JBZZ	Spacer	4	AE
1-19	LHLD-A554JBFZ	Heat sink holder	1	AE
1-20	PRDAFA157JBEZ	Heat sink for powertransistor module	1	AE
1-21	PSHE-A197JBEZ	Protect sheet	1	AH
1-22	PSEL-C061JBEZ	Insulator	1	AE
1-23	PSPA-A144JBE0	Spacer	1	AC
1-24	RFIL-A064JBE0	Ferrite core	2	AF
1-25	QW-VZD871JBZZ	Lead wire (L1+, L1-)	2	AG
1-26	QW-VZD857JBZZ	Lead wire (Earth)	1	AC
1-27	QW-VZD958JBZZ	Lead wire (DB1+-AFIN+)	1	AK
1-28	QW-VZD866JBZZ	Lead wire (T3 - TB2)	1	AF
1-29	QW-VZD864JBZZ	Lead wire (T2 - TBN)	1	AF
1-30	QW-VZD865JBZZ	Lead wire (T1 - TB1)	1	AF
1-31	QW-VZD863JBZZ	Lead wire (TBE - BHE)	1	AF
1-32	QW-VZE193JBZZ	Lead wire (9P LEAD)	1	AK
1-33	QW-VZE198JBZZ	Lead wire (2P LEAD)	1	AE
1-34	QW-VZD959JBZZ	Lead wire (DB1--AFIN-)	1	AG
1-35	QW-VZE194JBZZ	Lead wire (AFOUT--C8-)	1	AG
1-36	QW-VZE195JBZZ	Lead wire (AFOUT+-C8+)	1	AG
1-37	QW-VZE196JBZZ	Lead wire (C8-IPM/PWB)	1	AL
1-38	QW-VZE190JBZZ	Lead wire (MRY1-T6)	1	AE
1-39	QW-VZE191JBZZ	Lead wire (T5-DB1 AC2)	1	AF
1-40	QW-VZE192JBZZ	Lead wire (MRY1-DB1AC1)	1	AF
1-41	QW-VZE199JBZZ	Lead wire (ACT-CN13)	1	AF
1-42	QW-IZA035JBZZ	Lead wire (Compressor wire)	1	AR
1-43	RH-IXA699JBZZ	Microcomputer IC1	1	AZ
1-44	RH-IZA140JBE0	Integrated circuit IC3	1	AE
1-45	RH-TZA098JBE0	Transistor Q2, Q3, Q4	3	AB
1-46	RH-VZA020JBE0	Varistor CNR1, CNR2	2	AB
1-47	RH-VXA002JBZZ	Varistor NR1, NR2	2	AD
1-48	RH-VZA042JBE0	Surge absorber SA1	1	AH
1-49	LBNDKA106JBWZ	Capacitor clamp	1	AP
1-50	PSEL-C122JBEZ	Insulator	1	AC
1-51	PSEL-C123JBEZ	Insulator	1	AC
1-52	VHGPC817X3+1BS	Photo coupler (PC1,PC3-PC7,PC12)	7	AD
1-53	RHOG-A169JBE0	Thermistor (for Heatsink)	1	AK
		CABINET AND UNIT PARTS		
2- 1	LANGKA124JBPZ	Fan motor angle	1	AR
2- 2	LANGKA146JBPZ	Fan motor angle sub	1	AG
2- 3	GCAB-A196JBTA	Rear cabinet	1	BD
2- 4	LHLD-A573JBFA	Cord clamp	1	AC
2- 5	PFPFPB911JBEZ	Motor angle cushion	1	AC
2- 6	GCAB-A195JBTA	Front panel	1	BC
2- 7	GGADFA037JBFA	Fan guard	1	AT
2- 8	PSEL-C045JBEZ	Motor angle cushion	1	AB
2- 9	PSEL-C048JBEZ	F panel insulator	1	AC
2-10	PSEL-C049JBEZ	F panel insulator	1	AC
2-11	PSEL-C050JBEZ	Bulkhead insulator	1	AG
2-12	TLABBA148JBRA	Sharp badge	1	AH
2-13	CCHS-A807JBTA	Base pan assembly	1	BC
2-14	PFTA-A092JBFA	Side cover	1	AQ
2-15	PCOV-A616JBPZ	Protect cover	1	AE
2-16	MSPR-A026JBE0	Thermistor spring	1	AB
2-17	MSPR-A046JBE0	Protector spring	1	AC
2-18	NFANPA094JBEZ	Propeller fan	1	AX
2-19	PSKR-A211JBWZ	Bulkhead	1	AQ

REF. NO.	PART NO.	DESCRIPTION	Q'TY	CODE
2-20	TLABKD184JBEZ	Number card [AE-X10CR-N]	1	AC
2-20	TLABKC996JBRZ	Number card [AE-X10CR]	1	AC
2-21	TSPC-E267JBRZ	Name badge [AE-X10CR-N]	1	AE
2-21	TSPC-E033JBRZ	Name badge [AE-X10CR]	1	AE
2-22	PSEL-C051JBEZ	Side cover seal	1	AE
2-23	FFTA-A014JBKZ	Side cover assembly	1	AT
2-24	TLABCB644JBRZ	Wiring diagram	1	AD
2-25	DCAB-A119JBKZ	Top cover assembly	1	AZ
2-26	PSEL-C060JBEZ	Insulator for rear cabinet	1	AB
2-27	GCAB-A197JBTA	Top cover	1	AX
2-28	JHNDPA011JBFA	Holder	1	AS
2-29	PSEL-C046JBEZ	Bulkhead insulator	1	AC
2-30	PSEL-C119JBEZ	Box insulator	1	AE
2-31	PSEL-C047JBEZ	Box insulator	1	AF
2-32	PSEL-C062JBEZ	Box insulator	1	AG
2-33	CHLD-A093JBK0	Holder assembly	1	AL
2-34	PSEL-C121JBEZ	Side cover seal	1	AC
2-35	PSEL-C120JBEZ	Side cover seal	1	AC
2-36	LPLTPA026JBFA	Cord clamp plate	1	AC
2-37	PFPFPC208JBEZ	Insulator-S	1	AD
2-38	PSEL-C389JBEZ	Condenser insulator	1	AG

CYCLE PARTS

3- 1	CVLV-A626JBKZ	Reverse valve assembly	1	BR
3- 2	DCPY-A266JBKZ	Capillary tube assembly	1	BF
3- 3	PCON-A494JBPZ	Condensor	1	BQ
3- 4	DVLV-A529JBKZ	3 way valve unit	1	AW
3- 5	LX-NZA228JBE0	Service nut	1	AD
3- 6	LX-NZA227JBEZ	Bonnet	2	AT
3- 7	DVLV-A530JBKZ	2 way valve unit	1	CD
3- 8	PCMPRA328JBEZ	Compressor	1	AA
3- 9	LBSHCA005JBE0	Terminal bushing	1	AA
3-10	PCOV-0562JBE0	Terminal cover	1	AD
3-11	GLEG-A029JBE0	Compressor cushion	3	AE
3-12	PSPF-A840JBEZ	Compressor cover	1	AQ
3-13	PSPF-A841JBEZ	Compressor cover	1	AF
3-14	PSPF-A850JBEZ	Compressor cover	1	AG
3-15	PSPF-A851JBEZ	Compressor cover	1	AK
3-16	PSPF-A852JBEZ	Bulkhead cover	1	AG
3-17	PSEN-A044JBKZ	Flare nut ass'y	1	AG
3-18	PSEN-A045JBKZ	Flare nut ass'y	1	AK
3-19	PGUM-A135JBEZ	Compressor sheet	1	AG
3-20	PSPF-A839JBEZ	Compressor cover	1	AG
3-21	PMUF-A060JBEZ	Muffler	1	AP
3-21	PMUF-A061JBEZ	Muffler	1	AQ
3-22	PVLVXA030JBE0	Reverse valve	1	BC

SCREWS AND NUTS

4- 1	LX-BZA140JBE0	Special screw	20	AB
4- 2	LX-BZA072JBE0	Special screw (for 2/3 way valve unit)	4	AB
4- 3	XTTSA40P14000	Tapping screw	1	AA
4- 4	LX-BZA166JBE0	Special screw	3	AB
4- 5	LX-NZA026JBE0	Special nut (for compressor)	3	AC
4- 6	LX-BZA075JBE0	Special screw (for Earth)	1	AA
4- 7	LX-BZA140JBE0	Special screw	5	AB
4- 8	LX-BZA075JBE0	Special screw (for Earth)	1	AA
4- 9	XBPSD40P20J00	Machine screw (for IPM, for AF, for DB1)	5	AB
4-10	LX-NZA135JBE0	Special nut (for propeller fan)	1	AC
4-11	XCTSD40P12000	Tapping screw(for Terminal board ass'y angle,for capacitor clamp)	2	AA
4-12	XTPSD30P12XS0	Tapping screw 3mm x 16mm (for PWB assembly)	2	AC
4-13	LX-BZA292JBE0	Special screw 4mm x 16mm (for Top cover)	8	AC
4-14	XTTSD40P16000	Tapping screw (for Heatsink)	4	AA
4-15	XBPSD30P10000	Machine screw	1	AA
4-16	XCPSD40P16000	Tapping screw	1	AA

PACKING PARTS

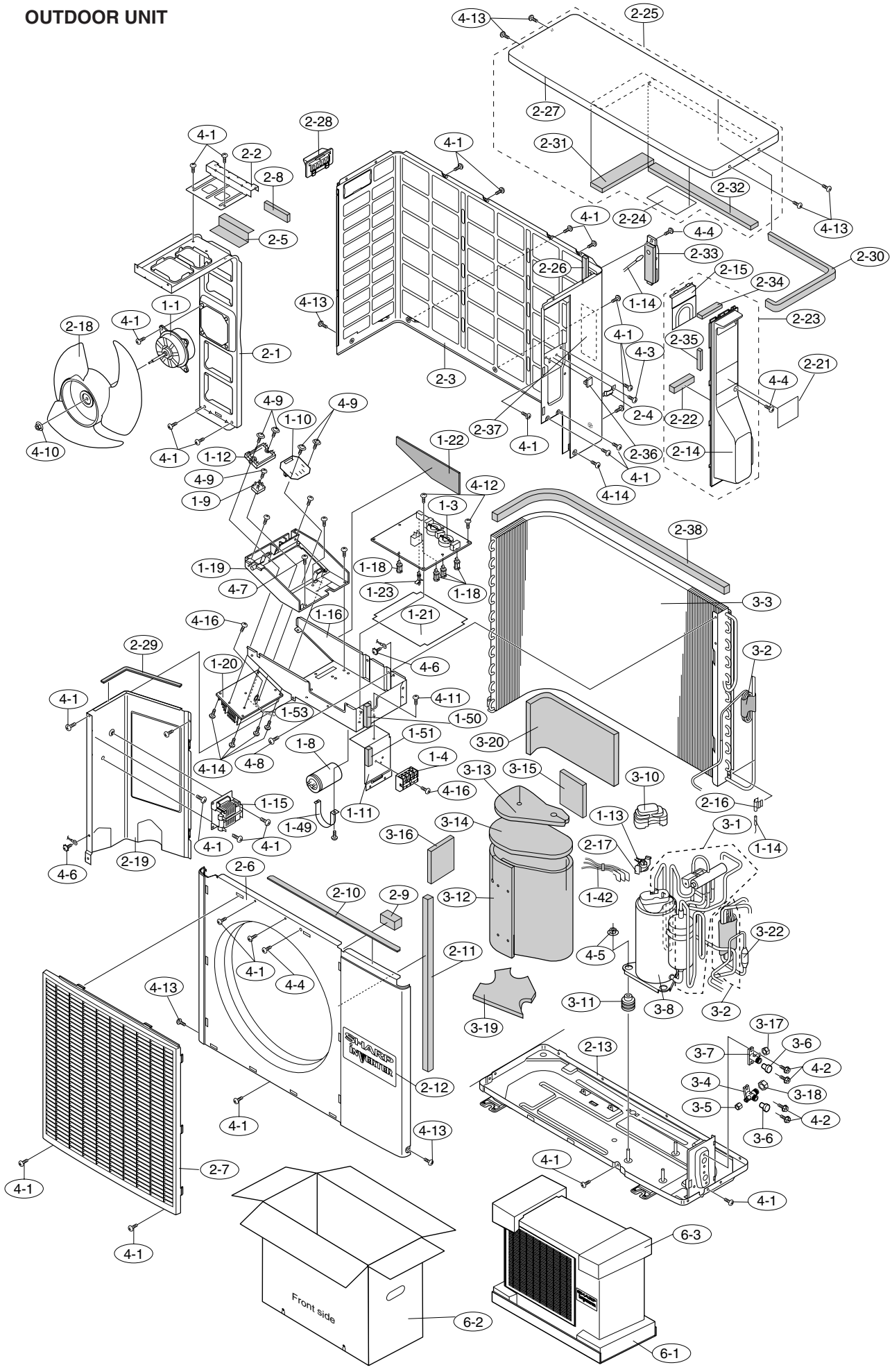
6- 1	CPADBA031JBKZ	Bottom pad assembly	1	AS
6- 2	SPAKCB169JBEZ	Packing case [AE-X08CR-N]	1	AU
6- 2	SPAKCA956JBEZ	Packing case [AE-X10CR]	1	AX

HOW TO ORDER REPLACEMENT PARTS

To have your order filled prompty and correctly, please furnish the following information.

1. MODEL NUMBER 2. REF. NO. 3. PART NO. 4. DESCRIPTION

OUTDOOR UNIT



Refrigerant Piping Installation / Servicing Manual for Air Condioners Using R-410A

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1. Outline

1. 1 Refrigerant R410A

(1) Adoption of R410A in Air Conditioners

In 1974, it was pointed out that ozone layer in the upper stratosphere (about 20 ~ 40 km above ground) might have been damaged by the ozone depleting substances such as CFC (chlorofluorocarbon) and HCFC (hydrochlorofluorocarbon). Since that time, many countries across the world have endeavored to take countermeasures against the ozone depletion.

As a refrigerant belonging to the HCFCs, the conventional refrigerant (R22) used in air conditioners also tends to deplete the ozone layer. Therefore, complying with the provisions of the international regulations (i. e. Montreal Protocol concerning the Ozone Depleting Substances) and national laws & regulations concerned, it is necessary to replace R22-with other types of refrigerant which do not deplete the ozone layer.

A refrigerant composed of hydrogen (H), fluorine (F) and carbon (C), is called an HFC and does not deplete the ozone layer. One HFC's is R410A whose pressure is about 1.6 times higher than R22 and whose energy efficiency is almost comparable to that of R22 at the same refrigerant temperature.

(2) Chemical Characteristics of R410A

a) Chemical Stability

Like R22, R410A is a chemically stable, less toxic and not-flammable refrigerant. However, as in the case of R22, the specific gravity of its vapour is larger than that of air and should it leak in an airtight room it may stay at a low level and cause an oxygen starvation accident. It may also, should it come in direct contact with file, cause a poisonous gas to occur, so be sure to handle it only in a well ventilated area.

Table 1. Comparison of Thermophysical Properties of R410 and R22

	R410A	R22
Composition (wt%)	R32/R125 (50/50)	R22 (100)
Molecular weight	72.6	86.5
Boiling point (˚C)	- 51.4	- 40.8
Vapor pressure (25˚C, MPa)	1.56	0.94
Saturated vapor density (25˚C, kg/m^2)	64.0	44.4
Inflammability	Nonflammable	Nonflammable
Ozone depletion potential (ODP)	0	0.055
Global warming potential (GWP)	1730	1700

Source: List of Thermophysical Properties complied by the Japan Sociery of Refrigeration and Air Conditioning, NIST REFPROP V5.10, etc.

b) Composition Changes (Pseudo-azeotropic Characteristics)

R410A is a pseudo-azeotropic mixed refrigerant composed of two constituents-R32 and R125. "Quasi-azeotropic" condition refers to a state in which the dew-point curve and boiling-point curve-gas-liquid equilibrium curves (pressure constant) -almost lie on top of each other, and a multi-constituent refrigerant having this chemical characteristic incurs less composition changes even when evaporation (or condensation) as a phase change occurs. Consequently, even when refrigerant leaks from the gas phase somewhere in the piping installation, the composition of circulated refrigerant incurs less changes.

Therefore, R410A can be treated in almost a same manner as a mono-constituent refrigerant like R22 is treated. When actually charging R410A, however, do so from the liquid phase side by taking into account the phenomenon that, when put in a cylinder, the composition changes a little between gas and liquid phases.

C) Pressure Characteristics

As shown in Table 2, since R410A's vapor-pressure is about 1.6 times higher than that of R22 at the same temperature, perform installation/ service with special toolsand materials which are exclusive for R410A and can withstand high pressure.

Table 2. Comparison of Saturated Vapor Pressure of R410 and R22

Refrigerant	R410A	R22
Temperature (˚C)		
- 20	0.30	0.14
0	0.70	0.40
20	1.35	0.81
40	2.32	1.43
60	3.73	2.33
65	4.15	2.60

Source: List of Thermophysical Properties complied by the Japan Sociery of Refrigeration and Air Conditioning, NIST REFPROP V5.10, etc.

(3) Lubricationg Oils for R410A

As the lubricating oils for R22, mineral oils, alkylbenze synthetic oils, etc. have so far been used. As R410A features less solubility with these conventional lubricating oils such as mineral oils, the lubricating oils tend to stay within the refrigeration cycle. As the lubricating oils highly soluble with R410A, ester, ethereal and other synthetic oils are available. However, as these synthetic oils are very hygroscopic, they must be treated even more carefully than the conventional lubricating oils. Furthermore, if these synthetic oils are mixed with mineral oils, alkylbenzene synthetic oils, etc., they may deteriorate, and block the capillary tubes, or cause the compressor to fail. So, never mix these synthetic oils.

1.2 Safety during Installation/Servicing

As R410A's pressure is about 1.6 times higher than that of R22, improper installation/servicing may cause a serious trouble. By using tools and materials exclusive for R410A, it is necessary to carry out installation/servicing safely while taking the following precautions into consideration.

1) Never use refrigerant other than R410A in an air conditioner which is designed to operate with R410A.
2) If a refrigeration gas leakage occurs during installation/servicing, be sure to ventilate fully.
   If the refrigerant gas comes into contact with fire, a poisonous gas may occur.
3) When installing or removing an air conditioner, do not allow air or moisture to remain in the refrigeration cycle. Otherwise, pressure in the refrigeration cycle may become abnormally high so that a rupture or personal injury may be caused.
4) After completion of installation work, check to make sure that there is no refrigeration gas leakage.
   If the refrigerant gas leaks into the room, coming into contact with fire in the fandriven heater, space heater, etc., a poisonous gas may occur.
5) When an air conditioning system charged with a large volume of refrigerant (e. g. multi type air conditioner) is installed in a small room, it is necessary to exercise care so that, even when refrigerant leaks, its concentration does not exceed the marginal level.
   If teh refrigerant gas leakage occurs and its concentration exceeds the marginal level, an oxygen starvation accident may result.
6) Be sure to carry out installation or removal according to the installation manual. Improper installation may cause refrigeration troule, water leakage, electric shock, fire, etc.
7) Unauthorized modifications to the air conditioner may be dangerous. If a breakdown occurs please call a qualified air conditioner technician or electrician.
   Improper repair's may result in water leakage, electric shock and file, etc.

2. Refrigerant Piping Installation

2.1 Piping Materials and Joints Used

For the refrigerant piping installation, copper pipes and joints are mainly used. Copper pipes and joints suitable for the refrigerant must be chosen and installed. Furthermore, it is necessary to use clean copper pipes and joints whose interior surfaces are less affected by contaminants.

(1) Copper Pipes

It is necessary to use seamless copper pipes which are made of either copper or copper alloy and it is desirable that the amount of residual oil is less than 40 mg/10m. Do not use copper pipes having a collapsed, deformed or discolored portion (especially on the interior surface). Otherwise, the expansion valve or capillary tube may become blocked with contaminants.

As an air conditioner using R410A incurs pressure higher than when using R22, it is necessary to choose adequate materials.

Thicknesses of copper pipes used with R410A are as shown in Table 3. Never use copper pipes thinner than 0.8 mm even when it is available on the market.

Table 3. Thicknesses of Annealed Copper Pipes

		Thicknesses (mm)	
Normal diameter	Outer diameter (mm)	R410	[ref.] R22
1/4	6.35	0.80	0.80
3/8	9.52	0.80	0.80
1/2	12.70	0.80	0.80
5/8	15.88	1.00	1.00

2.2 Processing of Piping Materials

When performing the refrigerant piping installation, care should be taken to ensure that water or dust does not enter the pipe interior, that no other oil other than lubricating oils used in the installed air conditioner is used, and that refrigerant does not leak. When using lubricating oils in the piping processing, use such lubricating oils whose water content has been removed. When stored, be sure to seal the container with an airtight cap or any other cover.

(1) Flare Processing Procedures and Precautions

a) Cutting the Pipe
By means of a pipe cutter, slowly cut the pipe so that it is not deformed.

b) Removing Burrs and Chips
If the flared section has chips or burrs, refrigerant leakage may occur. Carefully remove all burrs and clean the cut surface before installation.

c) Insertion of Flare Nut

d) Flare Processing
Make certain that a clamp bar and copper pipe have been cleaned.
By means of the clamp bar, perform the flare processing correctly.
Use either a flare tool for R410A or conventional flare tool.
Flare processing dimensions differ according to the type of flare tool. Be careful. When using a conventional flare tool, be sure to secure "dimension A" by using a gage for size adjustment.

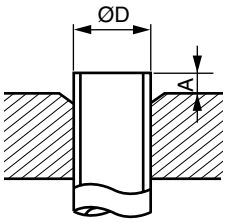

Fig. 3 Flare Processing DImensions

Table 4. Dimensions related to Flare Processing for R410A

Norminal diameter	Norminal diameter (mm)	Thickness (mm)	A (mm)		
			Flare tool fot R410A Clutch type	Conventional flare tool	
				Clutch type	Wing nut type
1/4	6.35	0.8	0 ~ 0.5	1.0 ~ 1.5	1.5 ~ 2.0
3/8	9.52	0.8	0 ~ 0.5	1.0 ~ 1.5	1.5 ~ 2.0
1/2	12.70	0.8	0 ~ 0.5	1.0 ~ 1.5	2.0 ~ 2.5
5/8	15.88	1.0	0 ~ 0.5	1.0 ~ 1.5	2.0 ~ 2.5

Table 5. Dimensions related to Flare Processing for R22

Norminal diameter	Norminal diameter (mm)	Thickness (mm)	A (mm)		
			Flare tool fot R410A Clutch type	Conventional flare tool	
				Clutch type	Wing nut type
1/4	6.35	0.8	0 ~ 0.5	0.5 ~ 1.0	1.0 ~ 1.5
3/8	9.52	0.8	0 ~ 0.5	0.5 ~ 1.0	1.0 ~ 1.5
1/2	12.70	0.8	0 ~ 0.5	0.5 ~ 1.0	1.5 ~ 2.0
5/8	15.88	1.0	0 ~ 0.5	0.5 ~ 1.0	1.5 ~ 2.0

Table 6. Flare and Flare Nut Dimensions for R410A

[Unit: mm]

Norminal diameter	Norminal diameter (mm)	Thickness (mm)	Dimension (mm)				Flare nut width
			A	B	C	D	
1/4	6.35	0.8	9.1	9.2	6.5	13	17
3/8	9.52	0.8	13.2	13.5	9.7	20	22
1/2	12.70	0.8	16.6	16.0	12.9	23	26
5/8	15.88	1.0	19.7	19.0	16.0	25	29

Table 7. Flare and Flare Nut Dimensions for R22

[Unit: mm]

Norminal diameter	Norminal diameter (mm)	Thickness (mm)	Dimension (mm)				Flare nut width
			A	B	C	D	
1/4	6.35	0.8	9.0	9.2	6.5	13	17
3/8	9.52	0.8	13.0	13.5	9.7	20	22
1/2	12.70	0.8	16.2	16.0	12.9	20	24
5/8	15.88	1.0	19.4	19.0	16.0	23	27

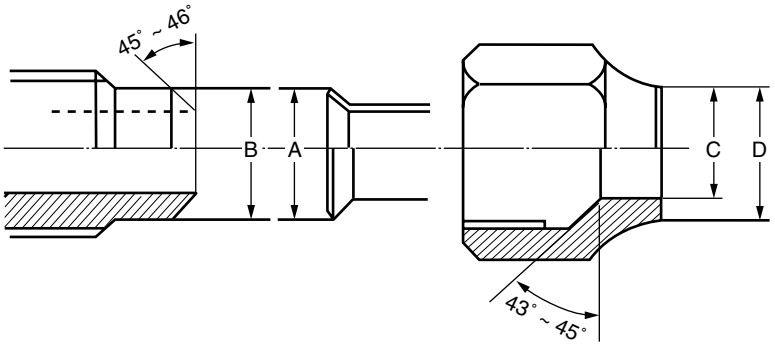

Fig. 4 Relations between Flare Nut and Flare Seal Surface

(2) Flare Connecting Procedures and Precautions

a) Make sure that the flare and union portions do not have any scar or dust, etc.

b) Correctly align the processed flare surface with the union axis.

c) Tighten the flare with designated torque by means of a torque wrench. The tightening torque for R410A is same as that for conventional R22. Incidentally, when the torque is wekd, the gas leakage may occur. When it is strong, the flare nut may crack and may be made nonremovable. When choosing the tightening torque, comply with values designated by manufacturers. Table 9 shows reference values.

Note:When applying oil to the flare surface, be sure to use oil designated by the manufacturer. If any other oil is used, the lubricating oils may deteriorate and cause the compressor to burn out.

Table 8. Tightening Torque of R410A [Reference Values]

Norminal diameter	Norminal diameter (mm)	Tightening torque N·m (kgf·cm)	Tightening torque of torque wrenches available on the market N·m (kgf·cm)
1/4	6.35	14 ~ 18 (140 ~ 180)	16 (160), 18 (180)
3/8	9.52	33 ~ 42 (330 ~ 420)	42 (420)
1/2	12.70	50 ~ 62 (500 ~ 620)	55 (550)
5/8	15.88	63 ~ 77 (630 ~ 770)	65 (650)

2.3 Storage of Piping Materials

(1) Types and Storage of Piping Materials

Refrigerant piping materials for air conditioners are broadly classified into the following types.

Refrigerant piping materials			General name
with heat insulation	with flare processing		: (a) Piping set
	without flare processing		: (b) Copper pipe with insulation
without heat insulation (bare copper pipe)	without flare processing		: (c) Bare copper pipe

As R410A features pressure about 1.6 times higher than R22, it is necessary to use a copper pipe which has a thickness stated in Table 3 and which contains less contaminants. It is necessary to carefully treat/store copper pipes so that they are not collapesd, deformed or damaged. Due care must also be exercised so that foreign matters such as dust and water do not enter the pipe interior.

A piping set's open end is sealed with a cap, etc. When storing it, make sure that it is sealed securely. When storing a cladded copper pipe or bare copper pipe, securely seal the opening with pinching, taping, etc.

(2) Identification

a) Piping set

A copper pipe as piping set for R410A must have a thickness as stated in Table 3, and, as shown in Tables 5 and 6, it also differs from R22 in flare processing and flare nut dimensions. So, it is necessary to choose a piping set suitable for R410A.

b) Copper Pipe with Insulation

Before using a copper pipe with insulation, make sure that is has a thickness designated for R410A.

c) Bare Copper Pipe

It is necessary to use a bare copper pipe which has a thickness desigtnated in Table 3 and contains less contaminants. As the bare copper pipe surface is naked, it is necessary to treat it with exceeding care and adopt a means for identification to prevent improper usage by making it easily discriminable from other piping materials.

(3) Precautions before Installation

Observe the following precautions when performing the piping connection at the site.

a) Keep any open ends of pipes be sealed with a cap, etc. until connected with the equipment.

b) Exercise great care when performing piping installation on a rainy day.
When water enters into the piping, the lubricating oil may deteriorate and cause the equipment to fail.

c) Carry out the piping connection in as short a time as possible.
If the piping is left open for a long period, fully purge the interior with nitrogen gas or dry it with a vacuum pump.

3. Installation, Removal and Servicing

3.1 Tools for R410A

In the case of an air conditioner using R410A, in order to prevent any other refrigerant from being chargedaccidentally, the service port diameter of the outdoor unit control valve (3-way valve) has been changed. Also, to increase the pressure resisting strength, flare processing dimensions and sizes of opposite sides of flare nuts (for copper pipes with nominal diameters 1/2 and 5/8) have been changed. During installation/service, therefore, prepare tools exclusive for R410A shown in (1) below and general tools shown in (2) on page 48.

(1) Tools Exclusive for R410A

a) Gauge Manifold

- As R410A is characterized by high pressure, conventional tools cannot be used.

Table 9. Differences between Conventional High/Low Pressure Gauges and Those for R410A

	Conventional gauges	Gauges exclusive for R410A
High pressure gauge (red)	- 0.1 ~ 3.5 MPa - 76 cmHg ~ 35 kgf/cm^2	- 0.1 ~ 5.3 MPa - 76 cmHg ~ 53 kgf/cm^2
Compound gauge (blue)	- 0.1 ~ 1.7 MPa - 76 cmHg ~ 17 kgf/cm^2	- 0.1 ~ 3.8 MPa - 76 cmHg ~ 38 kgf/cm^2

- In order to prevent any other refrigerant from being charged accidentally, each port of yhe manifold has been changed in shape.

Table 10. Differences in Port Size between Conventional Manifold and That for R410A

	Conventional manifold	Manifold for R410A
Port size	7/16 UNF 20 threads per inch	1/2 UNF 20 threads per inch

b) Charge Hose
- As R410A is characterized by high pressure, the pressure resistance of the charge hose has been increased. The material has also been changed to an HFC resistant type, and, as is the case of each port of the manifold, the hose cap size has been changed. Furthermore, for prevention of gas pressure reaction, a charge hose with a valve placed near the cap is also available.

Table 11. Differences between Conventional Charge Hose and That for R410A

		Conventional charge hose	Charge hose for R410A
Pressure resistance	Normal pressure	3.4 MPa (34 kgf/cm^2)	5.1 MPa (51 kgf/cm^2)
	Breaking pressure	17.2 MPa (172 kgf/cm^2)	27.4 MPa (274 kgf/cm^2)
Engineering material		NBR rubber	HNBR rubber internally coated with nylon
Cap size		7/16 UNF 20 threads per inch	1/2 UNF 20 threads per inch

c) Electronic Balance for Refrigerant Charging
- As R410A belonging to the HFCs features high pressure and high evaporating speed, when R410A is charged by using a charging cylinder, R410A in the cylinder cannot be kept in a liquefied state and gasified refrigerant bubbles in the charging cylinder, it becomes difficult to read values. Therefore, it is advisable to adequately use an electronic balance for refrigerant charging.
- An electronic balance for refrigerant charging has higher strength due to its structure with four points of support for refrigerant cylinder weight detection. As the charge hose connecting part has two ports-one for R22 (7/16 UNF 20 threads per inch) and the other for R410A (1/2 UNF 20 threads per inch)-it can also be used for charging the conventional refrigerant.
- Two types of electronic balance for refrigerant charging are available-one for 10 kg cylinder and the other for 20 kg cylinder.
  Electronic balance for 10 kg cylinder ..... precision ± 2g
  Electronic balance for 20 kg cylinder ..... precision ± 5g
- Refrigerant is charged maunally by opening/closing the valve.

d) Torque Wrench (for nominal diameters 1/2 and 5/8)
- Along with changes is flare nut sizes for enhanced pressure resisting strength, torque wrenches for R410A differ in opposite side size.

Table 12. Differences between Conventional Wrenches and Those for R410A

	Conventional torque wrench	Torque wrench for R410A
For 1/2 (opposite x torque)	24 mm x 55 N•m (550 kgf•cm)	26 mm x 55 N•m (550 kgf•cm)
For 5/8 (opposite x torque)	27 mm x 65 N•m (650 kgf•cm)	29 mm x 65 N•m (650 kgf•cm)

e) Flare Tool (clutch trpe)
- A flare tool for R410A is provided with a large clamp bar receiving hole so that the projection of the copper pipe from the clamp bar can be se at 0 ~ 0.5 mm in flare processing, and also features higher spring strength for increased expansion pipe torque. This flare tool can also be used for R22 copper pipe.

f) Gauge for Projection Adjustment (used when flare processing is made by using conventional flare tool [clutch type])
- A gauge 1.0 mm in thickness which helps in easily setting the projection of the copper pipe from the clamp bar at 1.0 ~1.5 mm.

g) Vacuum Pump Adapter
- It is necessary to use an adapter for preventing vacuum pump oil from flowing back to the charge hose. The charge hose connecting part has two ports-one for conventional refrigerant (7/16 UNF 20 threads per inch) and the other for R410A. If the vacuum pump oil (mineral) mixes with R410A, a sludge may occur and damage the equipment.

h) Refrigerant Cylinder
- A refrigerant cylinder exclusive for R410A comes identified with refrigerant name and is coated with pink paint as designated by the ARI, U. S. A

i) Charge Port and Packing for Refrigerant Cylinder
- According to the charge hose's cap size, a charge port with 1/2 UNF 20 threads per inch and corresponding packing are required.

j) Gas Leakage Detector
- A high sensitivity gas leakage detector exclusive for HFC refrigerant is used. In the case of R410A, the detection sensitivity is about 23 g per year.

(2) General Tools

a) Vacuum pump
b) Torque wrench
for 1/4 : opposite side 17 mm x (16 N·m) (160 kgf·cm)
for 1/4 : opposite side 17 mm x (18 N·m) 180 kgf·cm)
for 3/8 : opposite side 22 mm x (42 N·m) (420 kgf·cm)
c) Pipe cutter
d) Reamer
e) Screwdriver (+, −)
f) Hacksaw
g) Hole core drill (Ø65 or 70)
h) Hexagonal wrench (opposite side 4 or 5 mm)
i) Spanner, or monkey wrench
j) Tape measure
k) Thermometer
l) Clamping ampere meter
m) Insulation resistance tester (mege tester)
n) Electro circuit tester
o) Pipe bender

(3) Applicability or R410A Tools to R22 Model

Table 13. Applicability of R410A Tools to R22 Model

	Tools for R410A	Applicable to R22 model
a)	Gauge manifold	×
b)	Charge hose	×
c)	Electronic balance for refrigerant charging	○
d)	Torque wrench (norminal diameter 1/2, 5/8)	×
e)	Flare tool (clutch type)	○
f)	Gauge for projection adjustment ※	○
g)	Vacuum pump adapter	○
h)	Refrigerant cylinder	×
i)	Charge port and packing for refrigerant cylinder	×
j)	Gas leakage detector	×

※ Used when conventional flare tool (clutch type) is used.

Note: For inquiry, contact your agent.

3.2 New Installation Work (When Using New Refrigerant Piping)

(1) Air Purge by Vacuum Pump and Gas Leakage Inspection (See Fig. 6)

a) Connect the charge hose to the outdoor unit. ①
b) Connect the charge hose to the vacuum pump adapter. ②
At this time, keep the control valves in the fully closed position. ③ ④
c) Place the handle Lo in the fully opened position ⑤, and turn ON the vacuum pumpÅfs power switch. During this step, perform evacuating (about 10~15 minutes); for the evacuating time, refer to the equipment manufacturer's manual.
d) When the compound gauge's pointer has indicated -0.1 MPa (-76 cmHg) ⑥, place the handle Lo in the fully closed position ⑤, and turn OFF the vacuum pump's power switch.
Keep this state for 1 ~ 2 minutes, and ascertain that the compound gauge's pointer does not retum.
e) Fully open the control valves. ③ ④
f) Detach the charge hoses. ① ②
g) Tightly secure the cap on the service port. ⑦

h) After securing the caps on the control valves, check the caps periphery if there is any gas leakage. ③ ④ ⑦

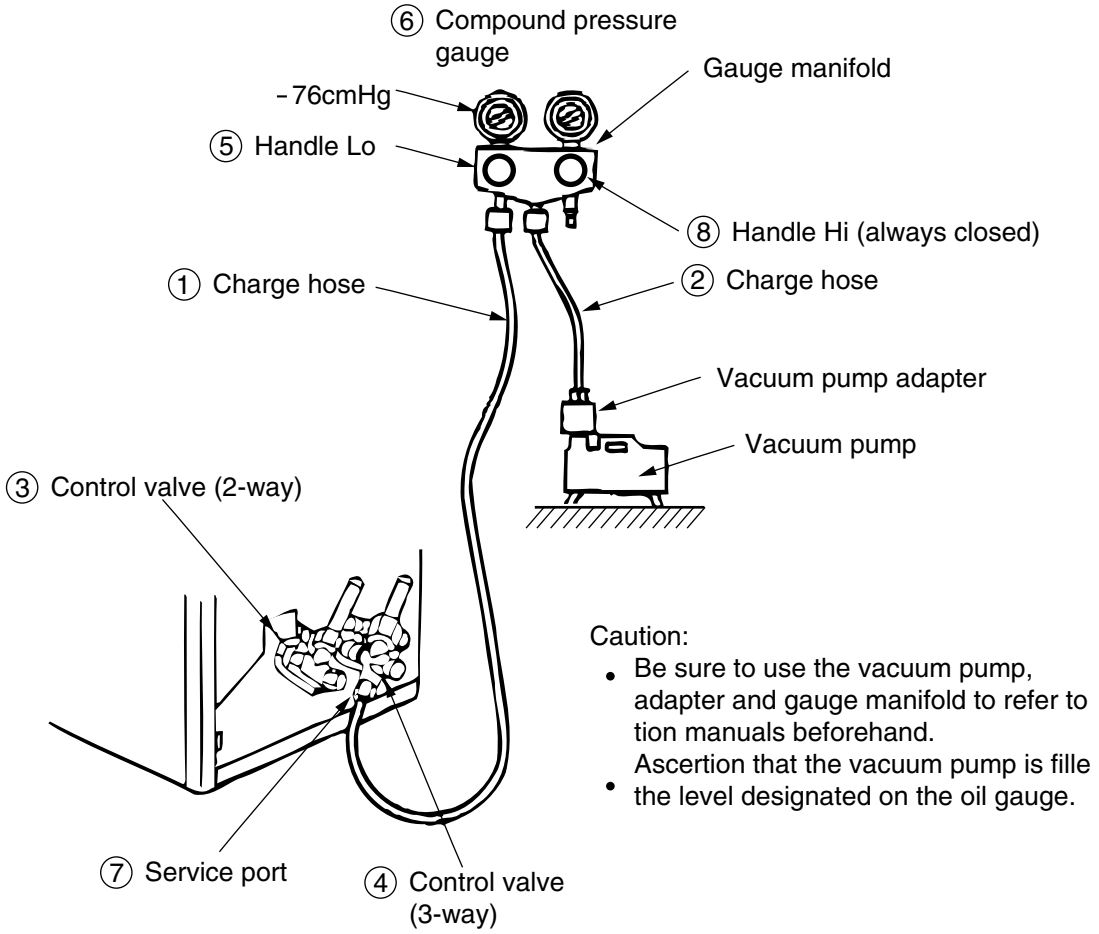
⑥ Compound pressure gauge
Gauge manifold
-76cmHg
⑤ Handle Lo
⑧ Handle Hi (always closed)
① Charge hose
② Charge hose
Vacuum pump adapter
Vacuum pump
③ Control valve (2-way)
Caution:
• Be sure to use the vacuum pump, adapter and gauge manifold to refer to tion manuals beforehand.
• Ascertion that the vacuum pump is fille the level designated on the oil gauge.
⑦ Service port
④ Control valve (3-way)

Fig. 6 Configuration of Air Purge by Vacuum Pump

(2) Additional Refrigerant Charging Required for Refrigerant Piping Length Longer Than Standard Length (The following steps should be taken following the step e) in (1) above. See Fig. 7)

a) Set the refrigerant cylinder to the electronic balance, and connect the connecting hoses on the cylinder and electronic balanceÅfs connecting port.

CAUTION

Be sure to make setting so that liquid con be charged. When using a cylinder equipped with a siphon, liquid can be charged without turning it upside down.

b) Connect the gauge manifoldÅfs charge hose to the electronic balanceÅfs connecting port. ③ ②

c) Open the refrigerant cylindesÅfs valve, and, after opening the charging valve a little, close it. ① ②

d) After making zero (0) adjustment, open the charging valve and, by opening the gauge maniflod's valve Lo, charge the liquid refrigerant. ② ⑤

e) When the designated amount of refrigrant could not be charged, make additional charging bit by bit by cooling operation (for the amount of each addition, follow the instruction manual prepared by the equipment manufacturer) . If the first additional charging was not enough, make the second additional charging after about one miunte in the same manner as the first additional charging.

CAUTION

Be sure never to charge a large amount of liquid refrigerant at once to the unit in cooling mode, since liquid is charged from the gas siede.

f) After charging liquid refrigerant into the air conditioner by closing the charging valve, stop operation by fully closing the gauge manifold's valve Lo. ② ⑤

g) Quickly remove the charge hose from the service port. ⑥
When stopped halfway, refrigerant being cycled will be released.

h) After securintg the caps on the service port and control valve, check the capsÅfperiphery to see if there is any gas leakage. ⑥ ⑦

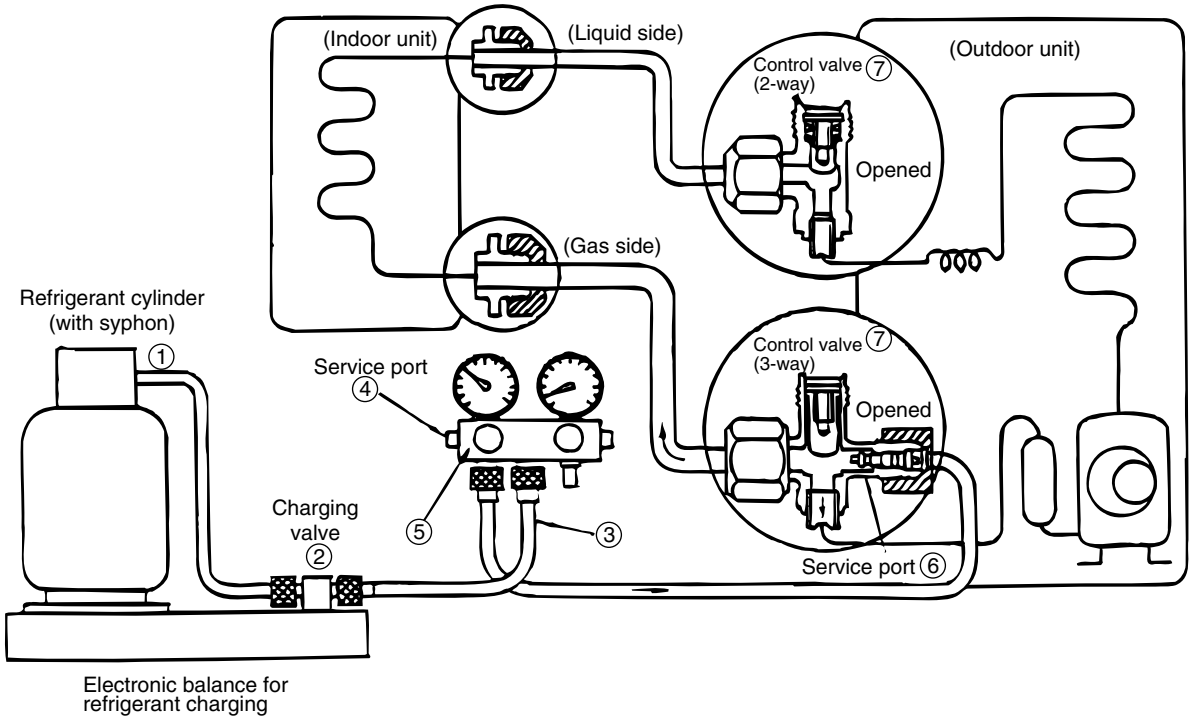

Fig. 7 Configuration of Additional Refrigerant Charging

3.3 Removal (When Using New Refrigerant Piping)

(1) Removing the Unit

a) Recovery of Refrigerant from the Outdoow Unit by Pump Down

- At the time of pump down, use a gauge manifold exclusive for R410A.
- Operating the unit in forced cooling mode, recover refrigerant from the outdoor unit.
  (For details of reclaiming steps and precautions, see the instruction manual prepared by the equipment maunfacturer)

- Caution:
  In the case of an outdoor unit which is inacapable pump down, use a refrigerant recovery unit.

b) Removing the Indoor/Outdoor Units

- Remove the piping and wiring between the indoor an outdoor units.
- Tighten the outdoor unitÅfs control valves and service port with the specified torque.
- Tighten the capped flare nuts at the indoor/outdoor units connecting part with the specified torque.
- Remove the indoor/outdoor units.

CAUTION
When storing the indoor unit piping in its original position, be careful not to break the piping.

(2) Installing the Unit

a) Proceed with the installation following the steps described in "3.2 New Installation Work" .

3.4 Replacing the Unit (Never Use the Existing Refrigerant Piping)

Use a brand-new refrigerant piping (1) when replacing the air conditioner using the conventional refrigerant (R22) with an air conditioner using the alternative refrigerant (R410A) or (2) even when replacing the air conditioner using the alternative refrigerant (R410A) with another air conditioner using R410A, as a problem may occur due to differences in pressure characteristics of refrigerant or differences in type of lubricating oil (air conditioners using R410A do not always use the same type of the lubricating oils) .

3.5 Retrofitting

Do not operate the air conditioner which has used the conventional refrigerant (R22) by charging the altemative refrigerant (R410A) . Otherwise, the equipment may cease to function normally and go wrong, or even cause serious problems such as rupture of the refrigeration cycle.

3.6 Refrigerant Recharging at Servicing

When it becomes necessary to recharge refrigerant, charge the specified amount of new refrigerant according to the following steps.
(For details, see the instruction manual prepared by the equipment manufacturer)

1) Connect the charge hose to the outdoor unit's service port.

2) Connect the charge hose to the vacuum pump abapter. At this time, keep the control valves in the fully opened position.

3) Place the handle Lo in the fully opened position, and turn ON the vacuum pumpÅfs power source. (For the evacuating time, refer to the equipment manufacturer's manual)

4) When the compound gauge's pointer has indicated - 0.1 MPa (- 76 cmHg), place the handle Lo in the fully closed position, and turn OFF the vacuum pump's power source. Keep this state for 1 ~ 2 minutes, and ascertain that the compound gaugeÅfs pointer does not refurn.

5) Charge liquid refrigerant by using the electronic balance according to the steps described in Section 3.2 (2) (pages 49).

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